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ABSTRACT

The Library Catalog Cost Model described in this report was developed to assist each of the 72 individual libraries participating in the project to compare the costs of alternative future forms of the catalog, emphasizing the costs of implementing AACR 2 (Anglo American Cataloging Rules 2). Inputs characterizing their costs and modes of operation were prepared by 68 libraries. These inputs were used to compute, by means of the model, costs of alternative forms of the catalog, including card, COM (computer output microfilm), and online. Analyses were performed of the inputs and the outputs of the model, and both were found to be highly variable. Thus it was difficult to draw general conclusions valid for groups of libraries regarding which alternative form of the catalog is the least costly. The costs of implementing AACR 2 were estimated to be of the order of four to seven percent of the total cost of developing and maintaining a catalog. The model may be a useful tool in planning, budgeting, and staffing work at an individual library; furthermore, it may be regarded as a prototype which could be modified to project costs to other library operations, especially acquisitions. Recommendations are presented for future model development. Appendices include edited versions of the basic material sent to participating libraries in July 1979 to assist them in compiling data to input to the Library Catalog Cost Model. Materials include: a background paper; general remarks concerning the model and its inputs; guidance for preparing the input form; input forms; and default figures. Numerous tables and figures are included in the report. (Author/THC)

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ALTERNATIVES FOR FUTURE LIBRARY CATALOGS: A COST MODEL

Final Report of the Library Catalog Cost Model Project Prepared for the Association of Research Libraries

Robert R. V. Wiederkehr

JUNE 1980

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Final report of the Library Catalog Cost Model Project
Prepared for the Association of Research Libraries

by
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June 1980

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ABSTRACT

Under the sponsorship of the Association of Research Libraries, King Research, Inc. developed a Library Catalog Cost Model, which is described in detail. This model was developed to assist each of the 72 individual libraries participating in this project in comparing the cost of alternative future forms of the catalog, emphasizing the costs of implementing AACR 2. Sixty-eight of these libraries prepared inputs characterizing their costs and modes of operation. These inputs were used to compute, by means of the model, costs of alternative forms of the catalog, including card, COM, and online. These results were found to be very useful by individual libraries. Analyses were performed of both inputs and the outputs of the model, and both were found to be highly variable. This made it very difficult to draw general conclusions valid for groups of libraries regarding which alternative form of the catalog is least costly. The costs of implementing AACR 2 were estimated to be of the order of four to seven percent of the total cost of developing and maintaining a catalog. The model can be a useful tool in planning, budgeting, and staffing work at an individual library; furthermore it may be regarded as a prototype which could be modified to project costs to other library operations, especially acquisitions. Recommendations are presented for future model development.

PART I

THE LIBRARY CATALOG COST MODEL PROJECT

CHAPTER 1

INTRODUCTION

Changes in the technology applicable to library catalog production are providing new alternatives for catalog formats. At the same time, pressures to close library card catalogs are mounting. These pressures include high labor costs for filing and maintenance, difficulties in searching large catalogs, physical deterioration and security of cards, and inconsistencies caused by overlays of changing cataloging rules and years of headings changes. The Library of Congress's decision to close its card catalogs on January 1, 1981 and to issue all post-1980 catalog records in conformance with the second edition of the Anglo-American Cataloging Rules (AACR 2) adds an especially compelling reason for libraries relying on LC cataloging to consider closing their catalogs.

Planning a change in catalog format is particularly difficult in research libraries where card catalogs are voluminous, catalog records are lengthy, and cataloging operations are often complex and very expensive. To assist directors and staffs of research libraries in choosing a future catalog format, the Association of Research Libraries sponsored the development of a computer model designed to identify and estimate the costs of producing and maintaining alternative catalog formats. The Association contracted with King Research, Inc. to produce the Library Catalog Cost Model and to use the model to derive cost estimates for libraries involved in the project. King Research subcontracted with Information Systems Consultants, Inc. to develop needed background information. Participation in the project was open to all ARL libraries and to libraries of other Ph.D. granting institutions. (Table 1.1 provides a list of the 72 libraries electing to participate.) The research required to develop and test the model was funded by the participating institutions.

Work on the project began on April 3, 1979, and, with the exception of preparing the final report, was scheduled for completion by September 30, 1979. The specific tasks, as identified in the contract, were: 1) definition of the problem, 2) identification of alternatives, 3) development of the cost model, 4) identification of non-cost factors, 5) preparation of a user manual for the model, 6) conduct of the first workshop (June 4-5, 1979), 7) refinement of the cost model, 8) field contact with selected participants, 9) processing of computer runs for individual libraries, 10) conduct of the final two-day workshop (September 10-11, 1979), and 11) preparation of the final report.

Because it was necessary to limit the scope of the project to conform to the time and funds available, noneconomic considerations in selecting a catalog format were not included in the model. These considerations, such as user services, are of utmost importance and, in any decision process, would be weighed against the cost information computed by the model. The background paper prepared for the project by Information Systems Consultants, Inc. for use by both King Research and the participants (included in this report as Appendix A) identifies factors to be considered in addition to costs.

During the course of the project, the rigidity of the workshop dates created a number of problems for both the contractors and the participating libraries. Insufficient time was available prior to the first workshop (June 4-5) to gather certain basic data needed to develop the model, particularly information on the costs of on-line catalogs. Also, the complexity of the model was considerably greater than anticipated. As a result, the preliminary version of the model presented at the first workshop was not as fully developed as had been planned, and instructions and input forms for supplying the data needed to compute costs were not sent to the participating libraries until July 5. Input forms for computer runs were to be completed by August 15 for the results to be reviewed at the September 10-11 workshop, allowing only six weeks for participants to gather facts and figures. The complexity of the model required rather extensive data collection and most of the participants found completing the input form to be a difficult and time consuming task. Therefore, the time restriction imposed on the participants significantly affected the reliability of the data supplied by these libraries as well as the costs estimated by the model on the basis of these data. To aid participants, default values for many of the figures required of participants were supplied by the contractors, but these too were necessarily hurriedly prepared. In addition, most default figures were derived through generalizations that might not apply in a particular library. (The default values are listed in Appendix E. The sources for many of these figures are described in the background paper shown in Appendix A.) It is important to keep in mind the deficiencies in the input data supplied during the project when studying the analyses of input figures and costs presented in Chapters 3 and 4.

The Library Catalog Cost Model developed during the project is described in Chapter 2 and in Part II of this report. The real value of the project must be based on the reliability and validity of the cost model itself and its applicability as a tool in planning future library catalogs. Many participants have installed copies of the cost model computer program at their own institutions and plan to continue to compute costs for alternative catalog formats using updated input data. Although this final report marks the completion of the Library Catalog Cost Model Project, the model can continue to be used for estimating costs of future library catalogs.

Table 1.1

LIBRARY CATALOG COST MODEL PROJECT PARTICIPANTS

Adelphi University Libraries

University of Akron Library

University of Alabama Libraries

University of Arizona Library

Arizona State University Library

Ball State University Library

Boston College Library

Boston University Library

Brigham Young University Library

University of California, Berkeley Library

University of California, Davis Library

University of California, Los Angeles Library

University of California, San Diego Library

University of California, Santa Barbara Library

Carnegie-Mellon University Library

Central Michigan University Library

Colorado State University Library

Cornell University Libraries

University of Delaware Libraries

Duke University Libraries

Emory University Library

University of Hawaii Library

University of Houston Libraries

Howard University Libraries

University of Illinois Library

University of Iowa Libraries

Iowa State University Library

Johns Hopkins University Library

University of Kansas Library

University of Kentucky Libraries

Kent State University Libraries

Louisiana State University Library

McGill University Library

McMaster University Library

University of Maine Library

University of Maryland Library

University of Massachusetts Libraries

Massachusetts Institute of Technology Libraries

Memphis State University Library

University of Miami Library

University of Michigan Library

Michigan State University Library

University of Minnesota Libraries

University of Missouri Library

University of New Mexico Library

New York State Library

North Texas State University Library

Table 1.1 (cont'd)

Notre Dame University Libraries

Ohio State University Libraries

University of Pennsylvania Libraries

Pennsylvania State University Library

University of Pittsburgh Library

Princeton University Library

Queen's University Library

University of Rochester Libraries

Rutgers University Library

San Jose State University Library

University of Southern California Library

Southern Illinois University at Carbondale Library

State University of N.Y. at Albany Library

State University of N.Y. at Buffalo Library

Temple University Library

University of Tennessee Libraries

Tulane University Library

University of Tulsa Library

University of Utah Libraries

University of Vermont Library

Virginia Polytechnic Institute & State University Library

University of Virginia Library

Wayne State University Libraries

University of Wisconsin Libraries

CHAPTER 2

THE LIBRARY CATALOG COST MODEL

2.1 Introduction

The purpose of the Library Catalog Cost Model is to estimate the economic costs to libraries for several different alternatives for future catalogs, including the costs associated with the implementation of AACR 2. Individual libraries can use the cost estimates produced by the model to compare the economic consequences of selected alternatives.

The Library Catalog Cost Model is based on the notion of the generalized library, a library whose general characteristics correspond approximately to those of each individual library applying the model. To describe the characteristics of the generalized library requires a set of parameters. These parameters include quantities such as the number of titles in the library on June 30, 1979, the number of titles newly cataloged during fiscal 1980, the average cost of cataloging a title during fiscal 1980, etc. An individual library can be approximated by the generalized library by specifying the numerical values of these parameters.

The Library Catalog Cost Model, in effect, is a procedure for estimating the costs to the generalized library for each of a number of alternative forms for future catalogs, and was developed as a result of the following steps:

1. identification of the different alternative forms of future library catalogs;
2. identification of the cost elements associated with each form;
3. development of relationships for estimating each cost element in terms of the set of parameters that characterizes the generalized library;
4. development of a computer program based on the cost element relationships that accepts a set of parameter values for an individual library as inputs and produces a table of cost components and total cost as outputs.

The result of step 4 is the Library Catalog Cost Model. It consists of a set of relationships, mostly equations, implemented as a computer program (written in FORTRAN) which transforms a set of input parameters into a set of output elements. The input parameters characterize a particular alternative form of the future catalog for an individual library; and the output elements detail the costs to that library of adopting the particular alternative form for its future catalog.

The following sections describe in detail steps 1, 2, and 3. The computer program developed as a part of step 4 has been documented separately, and distributed only to those project participants who ordered copies. The appendices provide guidance concerning the preparation of inputs for individual libraries.

2.2 Alternative Forms for Future Library Catalogs

From the Background Paper (Appendix A), a review of the literature, and exchanges with project participants, several alternative forms for future catalogs were identified. Of these, 12 were accepted for inclusion in the Library Catalog Cost Model. (Book catalogs, for example, were excluded from the model.) These 12 alternatives are listed in Table 2.1. They include unified catalogs and split catalogs.

The split catalog alternatives are geared to the 1st of January 1981, the date when ACCR 2 will be implemented by the Library of Congress. Before that date the current cataloging rules (AACR first edition) are assumed to be in effect; after that date, AACR 2 is assumed to be in effect. This difference in cataloging rules leads naturally to the concept of a split catalog with two files:

- o the old file - in which entries are cataloged under AACR 1
- o the new file - in which entries are cataloged under AACR 2.

The unified catalog alternatives ideally have all headings for an entity filed under a single form determined by one set of cataloging rules, such as AACR 2. In practice, it would be often too costly, especially for the older, larger libraries, to update all headings to conform to AACR 2 and achieve the ideal unified catalog. Instead cross-references would be used to connect entries filed under diverse forms. Nevertheless, some librarians refer to the resulting cross-referenced catalog as a unified catalog if the entries are filed in a single alphabet. This broader, but more practical, definition of a unified catalog blurs the distinction between a unified catalog and a split catalog with links filed under a single alphabet. Either perspective can be adopted when employing the Library Catalog Cost Model, as long as the values of all of the required inputs accurately reflect the operation and costs of the selected alternatives in a particular library. In other words, one may specify either a split catalog or a unified catalog as the alternative to be considered, but once the alternative is selected all the input parameters must accurately conform to a library's definition of that alternative.

In addition to choosing a unified or split catalog, one must consider the form when considering future alternatives for library catalogs. In this study we considered three forms: card, computer output microform (COM), and on-line catalogs. Book catalogs were not included because they are much costlier and bulkier than comparable COM catalogs.

Referring to Table 2.1, we see that alternatives 1 through 3 cover the three forms of unified catalogs. Alternatives 4 through 9 include the various combinations of split catalogs where the old file is either cards or COM (or filmed) and the new file appears in a single form. Alternatives 10 through 12 correspond to alternatives 5 and 6 except the new file appears in both a main form and a backup form.

Table 2.1
BASIC CATALOG ALTERNATIVES

Alternative Number		
	UNIFIED CATALOG	
	Form of unified file	
1.	Card	
2.	COM*	
3.	On-line	
	SPLIT CATALOG	
	A. Single form of old file, single form of new file.	
	Form of old file	Form of new file
4.	Card	Card
5.	Card	COM
6.	Card	On-line
7.	COM or other microform	Card
8.	COM or other microform	COM
9.	COM or other microform	On-line
	B. Single form of old file, two forms of new file.	
	Form of old file	Forms of new file: Main / Backup
10.	Card	COM / Card
11.	Card	On-line / Card
12.	Card	On-line / COM

*COM is an abbreviation for Computer Output Microform.

2.3 Cost Elements Associated with Each Alternative

The general costs included in the model are the costs of creating and maintaining library catalogs and certain other related costs. In accordance with the recommendations of the ARL Office of Management Studies, a planning period of five years was selected as the basis for estimating costs. Fiscal years rather than calendar years were selected to enable individual libraries to use their ARL statistics (which are collected on a fiscal year basis) as inputs to the model. The cost elements, therefore, are presented as model outputs for the five fiscal years 1981 through 1985, covering the period between July 1, 1980 and June 30, 1985. In addition, the total five year costs and the present discounted values are presented. (The discounted present value is a weighted five year cost, with weights that reflect the fact that the value of money varies with time. See Samuelson[1] or Alchain and Allen[2] for a discussion of present discounted values.)

Because different alternatives call for different cost elements, it is convenient to consider the union of cost elements over the twelve basic alternatives. This "union list" of cost elements and related output elements may be grouped into the following categories:

- Number and growth rate of titles and headings
- Costs of cataloging, editing, and authority control
- Additional costs of implementing AACR 2
- Costs specific to card catalogs
- Cost of retrospective conversion
- Costs specific to COM or other microform catalogs
- Costs specific to on-line catalogs
- Costs of training and orientation
- Costs of catalog use by non-cataloging staff
- Cost adjustments

To use the model efficiently, all of the cost elements in the "union list" are estimated. However, when a particular alternative is being considered, only those costs appropriate to that alternative are summed; the other cost elements are converted to zero.

Table 2.2 presents all of the cost elements included in the union list and Table 2.3 displays the element-alternative incidence matrix which governs the selection of elements used to calculate each alternative. In Table 2.2, each element is denoted by a mnemonic symbol and defined. In addition, reference is made to an equation that indicates how the element may be estimated from input parameters. These equations are explained briefly in Section 2.4 and developed in detail in Chapter 7.

[1]Samuelson, Paul A. Economics, New York, McGraw-Hill, 1979.
[2]Alchain, A. and W. Allen, University Economics, 2nd Edition, Belmont, California, Wadsworth, 1969.

Table 2.2
COST ELEMENTS AND OTHER OUTPUTS OF THE
LIBRARY CATALOG COST MODEL

Growth of Titles and Headings

1.	OTT(Y)	Total number of titles in the library on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Equation 5.
2.	OTTS(Y)	Total number of titles in the old file on June 30 of year Y with Y = 1, 2, 3, 4, 5, assuming the old file is maintained. Equation 11.
3.	OTNCF(Y)	Number of titles in the new card file on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Equation 17.
4.	OTNMRF(Y)	Number of titles in the new machine readable file on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Equation 22.
5.	OHT(Y)	Total number of headings in the library on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Where appropriate, this is equal to the number of headings in the authority file (excluding topical subjects). Equation 55.
6.	ONHC(Y)	Number of substantial heading conflicts resolved and treated in year Y. Equation 53.
7.	OFHC(Y)	Percentage of headings in the existing catalog that are in conflict with AACR 2 and not yet treated on June 30 of year Y. Equation 54.

Cost of Cataloging, Editing

8.	OCC(Y)	Cost of preparing catalog records in year Y. Equation 32.
9.	OCAC(Y)	Cost of maintaining authority file in year Y. (Does not include cost of authority work done during cataloging.) Equation 35.
10.	CEUCF(Y)	Cost of editing the unified card file in year Y. Equation 40.
11.	CEUMRF(Y)	Cost of editing the unified machine readable file in year Y. Equation 41.
12.	CEOF(Y)	Cost of editing the old file in year Y. Equation 33.
13.	CENCF(Y)	Cost of editing the new card file in year Y. Equations 36, 37.
14.	CENMRF(Y)	Cost of editing the new machine readable file in year Y. Equations 38, 39.

Table 2.2 (cont'd)

Additional AACR 2 Costs

15. OCRHC(Y) Cost of resolving heading conflicts resulting from AACR 2 during year Y. Equation 43.

16. OCHC(Y) Cost in year Y of making heading changes for titles of all classes. Equation 45.

17. OCL(Y) Cost in year Y of providing linkages, interfilings, etc., to resolve conflicts in headings resulting from AACR 2 for all titles. Equation 47.

Card Catalog Costs

18. CPC(Y) Cost of producing cards for titles newly cataloged during year Y. Equation 64.

19. CSF(Y) Cost of sorting and filing catalog cards in year Y. Equation 65.

20. CH(Y) Cost of the floor space in year Y for the card catalog of the unified file. Equation 69.

21. CHOF(Y) Cost of the floor space in year Y for the card catalog of the old file. Equation 70.

22. CHNF(Y) Cost of the floor space in year Y for the card catalog of the new file. Equation 71.

23. CM(Y) Cost of maintaining the unified card catalog during year Y. This includes the cost of pulling, physical change, refiling, etc., excluding the impact of AACR 2. Equation 66.

24. CMO(Y) Cost of maintaining the card catalog of the old file during year Y. Equation 67.

25. CMN(Y) Cost of maintaining the card catalog of the new file during year Y. Equation 68.

26. CNC(Y) Cost of acquiring new card cabinets in year Y. Equation 72.

27. CCE(Y) Labor cost of catalog expansion for the unified card file in year Y. Equation 73.

28. CCEN(Y) Labor cost of catalog expansion for the new card file in year Y. Equation 74.

Cost of Retrospective Conversion

29. CRECON(Y) Cost in year Y of creating machine readable records suitable for producing a COM or on-line catalog. Equation 77.

Table 2.2 (cont'd)

Cost of COM (or Filmed) Catalog

30.	CER(Y)	Cost in year Y of entering and creating machine readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records, for newly cataloged titles. This includes the cost of converting catalog records into a form suitable for producing a COM catalog. Equation 78.
31.	CSR(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the unified file in year Y. Equation 79.
32.	CSRO(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the old file in year Y. Equation 80.
33.	CSRN(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the new file in year Y. Equation 81.
34.	CMR(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the unified file in year Y. Equation 82.
35.	CMRO(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the old file in year Y. Equation 83.
36.	CMRN(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the new file in year Y. Equation 84.
37.	COMU(Y)	Cost in year Y of producing COM catalogs for the unified file. Equation 100.
38.	COMO(Y)	Cost in year Y of producing COM (or filmed) catalogs for the old file. Equation 98.
39.	COMN(Y)	Cost in year Y of producing COM catalogs for the new file. Equation 99.
40.	CCOMDO (Y)	Cost of delivering copies of the COM catalog of the old file in year Y. Equation 101.
41.	CCOMD(Y)	Cost of delivering copies of the COM catalog of the new or unified file in year Y. Equation 102.
42.	CCOMI(Y)	Cost of installing microform readers in year Y. Equation 104.
43.	CCOMSP(Y)	Cost of space for microform readers in year Y. Equation 105.

Table 2.2 (cont'd)

44. CCOMM(Y) Cost of maintaining microform readers in year Y. Equation 106.

Cost of On-line Catalog

45. CDEV(Y) Cost of development of the on-line catalog in year Y.

46. CINO(Y) Cost of installing the on-line system in year Y.

47. CHROA(Y) Cost of hardware rental or acquisition in year Y. Equation 107.

48. CTERM(Y) Cost of acquiring terminals in year Y.

49. CSP(Y) Cost of space associated with the on-line catalog in year Y.

50. CCOPMN(Y) Cost of operation and maintenance of on-line system in year Y. Equation 108.

Cost of Training

51. CTTS(Y) Cost of training technical services staff concerning changes in form of the catalog in year Y. (This includes the cost of labor and materials.) Input.

52. CTPS(Y) Cost of training public services staff concerning changes in the form of the catalog in year Y. Input.

53. COU(Y) Cost of orienting users concerning changes in the catalog in year Y. Input.

Cost of Usage

54. CS(Y) Cost of searches using catalog by non-cataloging staff in year Y. Equation 109.

Cost Adjustments

55. CPRL(Y) Costs (or savings) from personnel reallocation in year Y. Input.

56. CSPR(Y) Costs (or savings) from space reassignment in year Y. Input.

57. CED(Y) Costs (or savings) from equipment disposition in year Y. Input

58. CMISC(Y) Miscellaneous costs in year Y. These costs account for possible omissions in the preceding cost categories. Input.

Table 2.3.
OUTPUT ELEMENT - ALTERNATIVE INCIDENCE MATRIX

(1 indicates output element is included for the alternative; 0 indicates output element is excluded for the alternative)

Output Element		Alternative 1	2	3	4	5	6	7	8	9	10	11	12
1	OTT(Y)	1	1	1	1	1	1	1	1	1	1	1	1
2	OOTS(Y)	0	0	0	1	1	1	1	1	1	1	1	1
3	OTNCF(Y)	0	0	0	1	0	0	1	0	0	1	1	0
4	OTNMRF(Y)	1	1	1	1	1	1	1	1	1	1	1	1
5	OHT(Y)	1	1	1	1	1	1	1	1	1	1	1	1
6	ONHC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
7	OFHC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
8	OCC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
9	OCAC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
10	CEUCF(Y)	1	0	0	0	0	0	0	0	0	0	0	0
11	CEUMRF(Y)	0	1	1	0	0	0	0	0	0	0	0	0
12	CEOF(Y)	0	0	0	1	1	1	1	1	1	1	1	1
13	CENCF(Y)	0	0	0	1	0	0	1	0	0	1	1	0
14	CENMRF(Y)	0	0	0	0	1	1	0	1	1	1	1	1
15	OCRHC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
16	OCHC(Y)	1	1	1	1	1	1	1	1	1	1	1	1
17	OCL(Y)	1	1	1	1	1	1	1	1	1	1	1	1
18	CPC(Y)	1	0	0	1	0	0	1	0	0	1	1	0
19	CSF(Y)	1	0	0	1	0	0	1	0	0	1	1	0
20	CH(Y)	1	0	0	0	0	0	0	0	0	0	0	0
21	CHOF(Y)	0	0	0	1	1	1	0	0	0	1	1	1
22	CHNF(Y)	0	0	0	1	0	0	1	0	0	1	1	0
23	CM(Y)	1	0	0	0	0	0	0	0	0	0	0	0
24	CMO(Y)	0	0	0	1	1	1	0	0	0	1	1	1
25	CMN(Y)	0	0	0	1	0	0	1	0	0	1	1	0
26	CNC(Y)	1	0	0	1	0	0	1	0	0	1	1	0
27	CCE(Y)	1	0	0	0	0	0	0	0	0	0	0	0
28	CCEN(Y)	0	0	0	1	0	0	1	0	0	1	1	0
29	CRECON(Y)	1	1	1	1	1	1	1	1	1	1	1	1
30	CER(Y)	0	1	0	0	1	0	0	1	0	1	0	1
31	CSR(Y)	0	1	0	0	0	0	0	0	0	0	0	0
32	CSRO(Y)	0	0	0	0	0	0	1	1	1	0	0	0
33	CSRN(Y)	0	0	0	0	1	0	0	1	0	1	0	1
34	CMR(Y)	0	1	0	0	0	0	0	0	0	0	0	0
35	CMRO(Y)	0	0	0	0	0	0	1	1	1	0	0	0
36	CMRN(Y)	0	0	0	0	1	0	0	1	0	1	0	1
37	COMU(Y)	0	1	0	0	0	0	0	0	0	0	0	0
38	COMO(Y)	0	0	0	0	0	0	1	1	1	0	0	0
39	COMN(Y)	0	0	0	0	1	0	0	1	0	1	0	1
40	CCOMDO(Y)	0	0	0	0	0	0	1	1	1	0	0	0
41	CCOMD(Y)	0	1	0	0	1	0	0	1	0	1	0	1
42	CCOMI(Y)	0	1	0	0	1	0	1	1	1	1	0	1

Table 2.3 (cont'd)

Output Element	Alternative 1	2	3	4	5	6	7	8	9	10	11	12
43 CCOMSP(Y)	0	1	0	0	1	0	1	1	1	1	0	1
44 CCOMM(Y)	0	1	0	0	1	0	1	1	1	1	0	1
45 CDEV(Y)	0	0	1	0	0	1	0	0	1	0	1	1
46 CINO(Y)	0	0	1	0	0	1	0	0	1	0	1	1
47 CHROA(Y)	0	0	1	0	0	1	0	0	1	0	1	1
48 CTERM(Y)	0	0	1	0	0	1	0	0	1	0	1	1
49 CSP(Y)	0	0	1	0	0	1	0	0	1	0	1	1
50 CCOPMN(Y)	0	0	1	0	0	1	0	0	1	0	1	1
51 CTTS(Y)	1	1	1	1	1	1	1	1	1	1	1	1
52 CTPS(Y)	1	1	1	1	1	1	1	1	1	1	1	1
53 COU(Y)	1	1	1	1	1	1	1	1	1	1	1	1
54 CS(Y)	1	1	1	1	1	1	1	1	1	1	1	1
55 CPRL(Y)	1	1	1	1	1	1	1	1	1	1	1	1
56 CSPR(Y)	1	1	1	1	1	1	1	1	1	1	1	1
57 CED(Y)	1	1	1	1	1	1	1	1	1	1	1	1
58 CMISC(Y)	1	1	1	1	1	1	1	1	1	1	1	1

2.4 Relationships for Estimating Cost Elements and Related Quantities

To determine the cost elements appearing in Table 2.2 for a particular alternative at a particular library requires that values for a number of parameters that characterize the operations and costs of the library be estimated. These parameters are called the input parameters. Estimates of the input parameters can be obtained from observations of the libraries operations, or from findings reported by similar libraries. Table 2.4 presents a list of these input parameters and Appendix C provides guidance on how they can be estimated. (Appendix D is an input form based on Table 2.4.)

Table 2.4 is a natural by-product of a set of relationships for estimating the output elements appearing in Table 2.2. For each output element in Table 2.2 there is a relationship that links it to either input parameters or intermediate parameters. The intermediate quantities in turn depend on input parameters. Consequently, for each output element in Table 2.2 there are one or more relationships that link it to a set of input parameters. Table 2.4 is the union list of input parameters required to estimate all the output elements in Table 2.2.

An example should clarify this point. Consider the eighth entry in Table 2.2, OCC(Y), the cost in fiscal year Y of preparing catalog records for newly cataloged titles. A relationship for estimating OCC(Y) may be obtained by the following rationale. First, determine the cost of preparing records for titles of class I in year Y, and then sum the result over all classes of titles considered. Since the cost of preparing catalog records for titles of class I in year Y is the average cost of preparing catalog records for a class I title times the number of class I titles newly cataloged during fiscal year Y, we may write the following equation:

$$CC(I,Y) = CCPT(I) \cdot TN(I,Y), \quad Y=1, 2, 3, 4, 5$$

where $CC(I,Y)$ = the cost of preparing catalog records for titles of class I in year Y,

$CCPT(I)$ = the average cost of cataloging a title of class I, and

$TN(I,Y)$ = the number of titles of class I newly cataloged during fiscal year Y.

To be concrete, suppose that we have two classes of titles: monographs (I=1) and serials (I=2). Then the above equation applies twice in each fiscal year, once for monographs and once for serials. To obtain the cost of preparing catalog records for all classes of titles, i.e. both monographs and serials, we may write

$$OCC(Y) = CC(1,Y) + CC(2,Y).$$

Over the five year planning period selected for the cost analysis, the value of Y varies from 1 to 5, corresponding to fiscal 1981 through 1985. Consequently, the above equations each apply to five values of Y.

In the relationships for estimating the output element OCC(Y), there are two input parameters, CCPT(I) and TN(I,Y), and one intermediate parameter, CC(I,Y). Because there are two values of I, and five values of Y, two numerical values of CCPT(I) (one for monographs and one for serials) and ten numerical values of TN(I,Y) must be supplied to estimate OCC(Y) for the five fiscal years of the planning period.

In Chapter 7 relationships are developed for each output element in Table 2.2. The input parameters required by this collection of relationships are given in Table 2.4.

2.5 Use of the Model

An individual library may apply the model to estimate its costs for a specific form for its future catalog. These costs are produced as a result of a computer run.

To use the Library Catalog Cost Model, a library must first select an alternative from the list of 12 basic alternatives presented in Table 2.1. Second, the library must complete an input form which identifies the library, the run, the alternative selected, and numerical estimates for those input parameters required by that alternative. (Appendices A - E were developed to assist libraries in preparing these estimates.) Third, the input parameter values are keyed into the computer, and the computer is instructed to produce and display the corresponding outputs. This is done by means of an interactive, user-cordial computer program.

Table 2.5 lists the inputs for a run representing a typical ARL library. Table 2.6 presents the corresponding outputs. The run is based on alternative 5 (i.e. split catalog: old file-cards/new file-COM) for a library with 800,000 titles in its collection on June 30, 1980 (i.e. TTO(1) = 800,000). This typical ARL library catalogs 30,000 new titles each year (i.e. TN(1,Y) = 30,000, Y=1, 2, 3, 4, 5), withdraws 2,000 old titles each year (i.e. TW (1,Y) = 2,000), and incurs an average cost of cataloging a new title of $17.00 (i.e. CCPT(1) = 17.00). Values of other input parameters used to characterize the typical ARL library can be determined from Tables 2.5 and 2.4.

Table 2.4
INPUT PARAMETERS OF THE LIBRARY COST MODEL

Growth of Titles and Headings

NCT	Number of different classes of titles.
TN(I,Y)	Number of titles of class I newly cataloged during fiscal year Y.
TW(I,Y)	The number of titles of class I withdrawn from the library catalog in year Y, with Y = 1, 2, 3, 4, 5.
TTO(I)	Total number of titles of class I in the library and in the unified file on June 30, 1980.
TNCFS(I)	The number of titles of class I in the new card file on January 1, 1981.
TNMRFS(I)	The number of titles of class I in the new machine readable file on January 1, 1981.
HT(I,Y)	Total number of headings associated with titles of class I that are in the library on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Where appropriate, this is equal to the number of headings in the authority file (excluding topical subjects). For convenience, HT(I,0) is set equal to the number of such headings on January 1, 1981. (Optional input).
NHN(I,Y)	The number of unique headings associated with titles of class I newly cataloged during year Y, with Y = 1, 2, 3, 4, 5. For convenience, NHN(I,0) applies to titles cataloged between January 1, 1981 and June 30, 1981. (Optional input).
NHC(I,Y)	Number of substantial heading conflicts resolved and treated in year Y for titles of class I. (Optional input).

Cataloging and Editing Costs

CCPT(I)	Average cost of cataloging a title of class I. This cost encompasses the intellectual work of cataloging including pre-catalog searching, authority checking, etc. The average figure includes all types of cataloging, e.g., original cataloging, cataloging when LC copy is available, and cataloging when shared copy is available. This cost includes the cost of using the cataloging data base maintained by a bibliographic utility, but does not include the cost of maintaining a separate newly created data base to generate a public COM or on-line catalog.

Cataloging and Editing Costs (cont'd)

CACPT(I)	Average cost of maintaining authority file per title of class I. (Does not include cost of authority work done during cataloging).
CEOPT(I)	Annual cost of editing the old file per title of class I in the old file. This is the cost of intellectual work, not the physical maintenance.
CECPT(I)	Annual cost of editing the new or unified card file per title of class I in the file.
CEMRPT(I)	Annual cost of editing the new or unified machine readable file per title of class I in the file.

Additional AACR 2 Costs

PCTHC(I)	Percent of substantial heading conflicts in titles of class I resolved and treated by heading changes.
PCTL(I)	Percent of substantial heading conflicts in titles of class I resolved and treated by linkages, interfiling, etc.
CRCPC(I)	The average cost of intellectual work required to resolve a heading conflict resulting from AACR 2 for a title of class I.
CLPH(I)	Average cost of producing linkages, interfilings, etc. per heading conflict treated for class I titles.
CHCPR(I)	Average cost of making a heading change on an existing bibliographic record of a class I title.
RPH(I)	Average number of records requiring change per heading change for titles of class I.
FHCS(I)	Percentage of headings of class I titles in the existing catalog that are in conflict with AACR 2 on January 1, 1981.

Cost of Card Catalogs

K(I)	The average number of catalog cards required per title of class I for the old card catalog. If complete card sets are not filed for each title, then the average number of cards per title is less than the number of cards in a complete set.
KN(I)	The average number of catalog cards required per title of class I for the new or unified card catalog. For a split catalog KN(I) would normally equal K(I). However, if the

Table 2.4 (cont'd)

Cost of Card Catalogs (cont'd)

	new card catalog is used as a backup for a COM or on-line system, then KN(I) might be different from K(I). For example, if only a shelf list catalog is maintained as backup for the new catalog then KN(I) would equal 1.
FL	The percent of catalog cards produced locally. (The remainder are assumed to be produced by a network).
CCL(I)	The average cost of producing a catalog card locally for class I titles.
CN	The average cost of producing a catalog card by means of a network.
CFSPS	The cost of sorting and filing per card. This includes the cost of both manually produced and network produced cards, and the cost of filing revision.
FM(I)	The percent of cards for titles of class I requiring pulling, changing, refiling, etc., excluding the impact of AACR 2.
CMPC(I)	Average cost of pulling, changing, refiling and revision per card treated for class I titles.
CPCB	The average number of cards per cabinet.
SQPC	Square feet of floor space per cabinet (including space for reference table and users).
CCAB	The average cost of acquiring a card cabinet.
CSQ	Cost per square foot of floor space, e.g., rental cost if applicable.
CEPC	Labor cost of catalog expansion divided by the number of cabinets at the time of expansion.
PBCE	Period between catalog expansions for the new or unified file (in years).

Cost of Retrospective Conversion

NRT	The number of types of records used as the basis for the retrospective conversion.
RC(I,J,Y)	The planned number of machine readable records of class I titles suitable for producing a COM or on-line catalog for the new file created from records of type J during fiscal year Y, and after January 1, 1981.

Table 2.4 (cont'd)

Cost of Retrospective Conversion (cont'd)

RCO(I,J)	The number of machine readable or microform records of class I titles created from records of type J between June 30, 1980 and January 1, 1981.
CCPR(I,J)	The cost of creating a machine readable record suitable for producing a COM or on-line catalog for titles of class I from records of type J.

Cost of COM and Other Microform Catalogs

CERPT(I)	The average cost per newly cataloged title of class I of entering and creating machine readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records.
CSRPT(I)	The average annual cost per title of class I of storing machine readable records suitable for creating the COM catalog.
CMRPT(I)	The average cost per title of class I of maintaining machine readable records. This includes the cost of keying corrections, making deletions, etc., excluding the impact of AACR 2. This does not include the intellectual work of editing.
LPFO	Lines of output per fiche if a fiche catalog is produced (or lines of output per foot of film if a film catalog is produced) in the old file.
LPF	Lines of output per fiche if a fiche catalog is used (or lines of output per foot of film if a film catalog is produced) in the new or unified file.
LPSRO(I)	Lines of output per short bibliographic record of class I titles in the COM or microform catalog of the old file.
LPFR(I)	Lines of output per full bibliographic record of class I titles in the COM catalog of the new or unified file.
LPSR(I)	Lines of output per short bibliographic record of class I titles in the COM catalog of the new or unified file.
CPMFO	Cost per master fiche (or cost per foot or master film) for the microform catalog of the old file.
CPCFO	Cost per copy fiche (or cost per foot of copy film) for the microform catalog of the old file.
CPCF	Cost per copy fiche (or cost per foot of copy film) for the COM catalog of the new or unified file.

Table 2.4 (cont'd)

Cost of COM and Other Microform Catalogs (cont'd)

NCO(Y)	Number of copies of the microform catalog produced for each update and each supplement of the old file in year Y.
NC(Y)	Number of copies of the COM catalog produced for each update and each supplement of the new or unified file in year Y.
NUO(Y)	Number of updates per year of the entire microform catalog of the old file.
NU	Number of updates per year of the entire COM catalog of the new or unified file.
NS	The number of cumulative supplements of the COM catalog of the new or unified file produced per year.
NSO(Y)	The number of cumulative supplements of the COM catalog of the old file produced in year Y.
TPSO	The average number of titles appearing in each cumulative supplement of the old file.
CORO	A correction factor for the cost of producing the microform catalog of the old file. This factor corrects for costs which are not proportional to the number of titles in the catalog.
COR	A correction factor for the cost of producing the COM catalog of the new or unified file.
NFRPTO(I)	The average number of full bibliographic records per title of class I in the COM (or other microform) catalog of the old file.
NFRPT(I)	The number of full bibliographic records per title of class I in the COM catalog of the new or unified file. (The alternative selected determines whether the new or unified file is considered).
NSRPTO(I)	The number of short bibliographic records per title of class I in the COM or other microform catalog of the old file.
NSRPT(I)	The number of short bibliographic records per title of class I in the COM catalog of the new (or unified) file.
CPRO(I)	The cost of processing a record of a class I title to produce a COM (or filmed) catalog of the old file.
CDCOM	Average cost of delivering and preparing for display a COM catalog.

Table 2.4 (cont'd)

Cost of COM and Other Microform Catalogs (cont'd)

CMCOM	Average cost of maintaining a microform reader.
CSPCOM	Cost of space for one microform reader.
CICOM	Cost of acquiring and installing a microform reader.
NCOMRI(Y)	The number of microform readers acquired and installed in year Y, Y = 1, 2, 3, 4, 5.
NCOMRI(O)	The total number of microform readers in the library in year 0.

Cost of On-line Catalogs

CSP(Y)	Cost of space associated with the on-line catalog in year Y.
CHWA(Y)	Cost of acquiring computer processing hardware (CPU, console, tape drive, etc.) in year Y.
CDA(Y)	Cost of acquiring disk drives in year Y.
CTERM(Y)	Cost of acquiring terminals in year Y.
CDEV(Y)	Cost of development of the on-line catalog in year Y.
CINO(Y)	Cost of installing the on-line system in year Y.
CEO(Y)	Cost of equipment operators in year Y.
CHWM(Y)	Cost of hardware maintenance in year Y.
CSWM(Y)	Cost of software maintenance in year Y.
CDBM(Y)	Cost of data base maintenance in year Y.
CCRENT(Y)	Cost of computer rental in year Y.

Cost of Training and Orientation

CTTS(Y)	Cost of training Technical Services Staff concerning changes in form of the catalog in year Y. (This includes the cost of labor and materials).
CTPS(Y)	Cost of training Public Services Staff concerning changes in the form of the catalog in year Y.
COU(Y)	Cost of orienting users concerning changes in the catalog in year Y.

Table 2.4 (cont'd)

Cost of Catalog Usage by Non-cataloging Staff

NSERO(Y)	Number of searches in year Y by staff using old catalog.
NSER(Y)	Number of searches in year Y by staff using new or unified catalog.
NECPSO	Number of entries checked to complete a search in the old file.
NECPS	Number of entries checked to complete a search in the new or unified file.
TCEO	The average time to check an entry in the old file (seconds).
TCE	The average time to check an entry in the new or unified file (seconds).
CSTPH	The average cost of staff time per hour.

Cost Adjustments

CPRL(Y)	Costs (or savings) from personnel reallocation in year Y.
CSPR(Y)	Costs (or savings) from space reassignment in year Y.
CED(Y)	Costs (or savings) from equipment disposition in year Y.
CMISC(Y)	Miscellaneous costs in year Y. These costs account for possible omissions in all the preceding cost categories.

Inflation and Present Value

ROI	Rate of inflation (percent)
DR	Real discount rate (percent)

TABLE 2.5
INPUT PARAMETERS FOR A SAMPLE PROBLEM

```
LIB - TYPICAL ARL LIBRARY
RID - 001M OLD CARD, NEW COM
DOS - SEPT. 10,'78


NLT
          5

NCT
          1

NRT
          2

  1  TN(I,Y)
   30000.0000     30000.0000     30000.0000     30000.0000     30000.0000

  2  TTO(I)
    800000.0000

  3  TNMRFS(I)
         .0000

  4  TW(I,Y)
    2000.0000      2000.0000      2000.0000      2000.0000      2000.0000

  5  HTO(I)
         .0000

  6  HT(I,Y)
         .0000          .0000          .0000          .0000          .0000

  7  NHN(I,Y)
         .0000          .0000          .0000          .0000          .0000

  8  CCPT(I)
        17.0000

  8  CEOPT(I)
         .0200

 10  CEMRPT(I)
         .0150

 11  CCPR(I,J)
        1.3500          .0500

 12  RC(I,J,Y)

J = 1
   10000.0000     10000.0000     10000.0000     10000.0000     10000.0000

J = 2
  200000.0000          .0000          .0000          .0000          .0000
```

TABLE 2.5 (Cont'd)

```
13  HCO(I,J)
        .0000          .0000

14  CACPT(I)
        .0200

15  CRCPC(I)
       2.5000

16  PCTHC(I)
     100.0000

17  PCTL(I)
        .0000

18  CHCPR(I)
        .3250

19  CLPH(I)
        .2000

20  RPH(I)
     120.0000

21  FHCS(I)
      13.0000

22  NHC(I,Y)
        .0000          .0000          .0000          .0000          .0000

23  K(I)
       8.0000

24  CMPC(I)
        .2250

25  FM(I)
       1.3000

26  CPCB
  82000.0000

27  SOPC
     30.0000

28  CSG
       5.0000

29  NCOMRO
     30.0000
```

TABLE 2.5 (Cont'd)

```
30  NCOMRI(Y)
       5.0000          5.0000          5.0000          5.0000          5.0000

31  NC(Y)
      35.0000         40.0000         45.0000         50.0000         55.0000

32  NU
       4.0000

33  NS
       8.0000

34  CERPT(I)
        .0500

35  CSRPT(I)
        .0100

36  CMRPT(I)
        .0300

37  NFRPT(I)
       1.0000

38  NSPRT(I)
       7.0000

39  LPFR(I)
       7.0000

40  LPSR(I)
       3.0000

41  CPR(I)
        .0080

42  LPF
   16000.0000

43  CPMF
       4.8000

44  CPCF
        .2500

45  COR
        .0000

46  CMCOM
      25.0000
```

TABLE 2.5 (Cont'd)

```
47  CDCOM
      2.0000

48  CICOM
     815.0000

49  CSPCOM
     125.0000

50  CTTS(Y)
    6750.0000     3300.0000        .0000        .0000        .0000

51  CTPS(Y)
    3250.0000     1600.0000        .0000        .0000        .0000

52  COU(Y)
    1500.0000      800.0000      800.0000      800.0000      800.0000

53  NSERO(Y)
   83000.0000    72000.0000    67000.0000    64000.0000    61000.0000

54  NSER(Y)
   17000.0000    28000.0000    33000.0000    36000.0000    39000.0000

55  NECPSO
      1.5000

56  NECPS
      1.5000

57  TCEO
     70.0000

58  TCE
     80.0000

59  CSTPH
     10.0000

60  CPRL(Y)
        .0000         .0000         .0000         .0000         .0000

61  CSPR(Y)
        .0000         .0000         .0000         .0000         .0000

62  CED(Y)
        .0000         .0000         .0000         .0000         .0000

63  CMISC(Y)
        .0000         .0000         .0000         .0000         .0000
```

TABLE 2.6
OUTPUT PRODUCED BY THE LIBRARY CATALOG COST MODEL
(FOR THE SAMPLE PROBLEM OF TABLE 2.5)

LIBRARY CATALOG COST MODEL

LIB - TYPICAL ARL LIBRARY
RID - 001M OLD CARD, NEW COM
DOS - SEPT. 10,'78
ALT - 5, SPLIT CARD/COM

	FISCAL YEAR				
	1981	1982	1983	1984	1985
NUMBER OF TITLES					
TOTAL IN LIBRARY	828000	856000	884000	912000	940000
OLD FILE	813000	811000	809000	807000	805000
NEW FILE: MR	225000	265000	305000	345000	385000
NUMBER OF HEADINGS					
TOTAL IN LIBRARY	662705	684427	706210	728049	749936
NUMBER OF CONFLICTS TREATED	1307	2338	2183	2081	1942
% IN CONFLICT	12.6	11.8	11.2	10.8	10.0

COSTS (IN DOLLARS) WITH INFLATION RATE = 0%

	FISCAL YEAR						
	1981	1982	1983	1984	1985	TOTAL	PRESENT VALUE
CATALOGING, EDITING							
INITIAL CATALOGING	510000	510000	510000	510000	510000	2550000	1933288
AUTHORITY CONTROL	16280	16840	17400	17960	18520	87000	65534
EDITING							
OLD	16205	16240	16200	16160	16120	80925	61389
NEW: MR	844	3675	4275	4875	5475	19144	13743
SUBTOTAL	543329	548755	547875	548895	550115	2737069	2073964
ADDITIONAL AACR-2 COSTS							
RESOLVING CONFLICTS	3268	5844	5482	5153	4855	24602	18650
CHANGING HEADINGS	50978	91163	85512	80394	75742	383789	287869
PROVIDING LINKAGES	0	0	0	0	0	0	0
SUBTOTAL	54246	97007	90994	85547	80597	408391	306319

(Continued)

TABLE 2.6 (Cont'd)

CARD CATALOG							
STORAGE: OLD	15682	15718	15677	15639	15600	78314	59388
MAINTENENCE: OLD	18960	18001	18954	18907	18860	94682	71802
SUBTOTAL	34642	34717	34631	34546	34480	172998	131191
RETROSPECTIVE CONVERSION	23500	13500	13500	13500	13500	77500	60264
COM (OR FILMED) CATALOG							
ENTERING NEW TITLES	1500	1500	1500	1500	1500	7500	5883
DATA STORAGE: NEW	1175	2450	2850	3250	3650	13325	9872
DB MAINTENANCE: NEW	3375	7350	8550	9750	10950	38975	29023
CATALOG PRODUCTION							
NEW	40978	81482	96091	111399	127407	457355	331980
SET UP FOR DISPLAY							
NEW/UNIFIED	840	960	1080	1200	1320	5400	4005
READERS							
ACQUIRE AND INSTALL	4075	4075	4075	4075	4075	20375	15445
SPACE	4375	5000	5625	6250	6875	28125	20871
MAINTENANCE	875	1000	1125	1250	1375	5625	4172
SUBTOTAL	57141	103817	120896	138674	157152	577880	429851
TRAINING, ORIENTATION							
T.S. STAFF	6750	3300	0	0	0	10050	8863
P.S. STAFF	3250	1600	0	0	0	4850	4278
USER ORIENTATION	1500	800	800	800	800	4700	3887
SUBTOTAL	11500	5700	800	800	800	19600	16808
CATALOG USAGE BY NC STAFF	29875	30333	30542	30687	30792	152209	113237
COST ADJUSTMENTS							
PERSONNEL	0	0	0	0	0	0	0
SPACE	0	0	0	0	0	0	0
EQUIPMENT	0	0	0	0	0	0	0
MISCELLANEOUS	0	0	0	0	0	0	0
SUBTOTAL	0	0	0	0	0	0	0
GRAND TOTAL	754233	831829	839238	852729	867416	4145445	3124632

CHAPTER 3

ANALYSIS OF INPUTS SUBMITTED BY PARTICIPANTS

3.1 Preparation of Inputs

The Library Catalog Cost Model described in the previous chapter was developed in May and June of 1979. In order to apply the model participating libraries prepared estimates for each input parameter and completed an input form for each case of interest to them. Libraries were asked to return the forms to King Research, Inc. by mid-August 1979. To assist them in this effort, participating libraries were provided in early July 1979 with the material contained in Appendices A through E.

The relatively short period available for the preparation of inputs (early July to mid-August) was dictated by the firm workshop date of September 10, 1979, fixed by the original contract. Those charged with the responsibility of completing input forms generally felt that more time for understanding the significance of parameters and for preparing reliable estimates of them would have been highly desirable; they noted that the quality of the input parameter estimates sometimes suffered.

Despite these qualms, there are good reasons for proceding with the analysis of the inputs. First, in examining a number of parameters previously unfamiliar to the library community it is better to present a preliminary and possibly somewhat foggy picture of these parameters than to present no picture at all. Second, by pressing ahead with the analysis of inputs and the resulting costs, we can begin to appreciate the relative importance of the various input parameters by means of sensitivity analyses; in other words, we can begin to separate the key input parameters from the relatively insignificant ones. Section 4.3 is a beginning of such a sensitivity analysis.

At King Research, Inc. the data appearing on each completed input form were keyed into the computer to form an input record. Each library was assigned an input file containing one input record for each desired computer run. Each input record contained values for every input parameter, but when the parameter was not required (e.g. COM catalog costs are not required when considering a unified card catalog) a value of zero was entered automatically.

The input files from the 68 libraries that submitted at least one input form constituted the basis for this input analysis.

3.2 Analysis of Inputs

The analysis of input parameters was limited to 242 main runs* initially judged to contain reasonable estimates for the input parameters. Excluded from this analysis were 75 branch runs*, 15 runs explicitly withdrawn by libraries who believed their input values to be suspect, and 47 runs that were temporarily withheld by

*The principal kinds of runs that can be made using the Library Catalog Cost Model are main runs, branch runs, and combining runs. Main runs estimate the costs for the main library (or an aggregate of the main library and the branches). Branch runs estimate the costs for one or more branch libraries. Combining runs estimate the costs for a collection of libraries, typically the main library and a number of branches. See Appendix B for more details.

libraries pending revision of selected input parameters. Also excluded from the analysis were all the combining runs; these runs introduced no new input parameter values.

The first attempt to analyze the statistical properties of the input parameters for these 242 runs revealed certain difficulties. A few parameters had maximum values that were unreasonably large. For example, one library entered a number close to 200,000 for CCPR (1,1), the cost in dollars of converting a record of a given type (e.g. shelf-list cards) to machine readable form suitable for producing a COM or online catalog. Normally this number is less than $5.00. For a handful of parameters, the maximum values contained more significant digits than allowed for in the printout.

These difficulties with the maximum value were overcome by rejecting from the analysis parameter values that exceeded certain reasonable bounds (e.g. TN, the number of titles newly cataloged each year, could not exceed 100,000; the total number of titles in the library, TTO, could not exceed 4,000,000; the average number of cards per cabinet, CPCB, could not exceed 100,000). Also rejected from the analysis were parameter values equal to zero. Because of these two types of rejections, the number of observations used for estimating the statistical properties of a given input parameter is sometimes less than 242.

Table 3.1 presents resulting properties of the input parameters required by the library cost model. Table 3.1 also includes, where appropriate, default values* for the parameter. The first column lists the symbols for most of the input parameters. Definitions of these symbols are given in Table 2.4. Input parameters with fewer than four non-zero observations are not included among the parameters. The second column of Table 3.1 lists the number of runs with non-zero values for the parameter. These runs were used to estimate the mean, the standard deviation, the minimum and the maximum, statistical properties that are given in columns 5, 6, 7 and 8, respectively. The third column gives the number of runs that used a default value, and the fourth column gives the value or values of default figures. The results of Table 3.1 were produced using SPSS (Statistical Package for the Social Sciences).

To put the 242 runs on a common basis, certain simplifications were introduced. For example, possible values of TN(I,Y) correspond to 4 possible classes of titles (I=1, 2, 3, 4) over 5 years (Y=1, 2, 3, 4, 5). in such cases, only the sum** over all classes of titles in the first year, TN(·,1) was included.

For TN(I,Y) one would expect relatively small variations over the planning period, so setting Y=1 yields a representative value. On the other hand, for a quantity such as the cost for computer hardware acquisition, CHWA(Y), which might be high initially and low or moderate later on, we looked at its value in each year of the planning period and its average value as well. The average value of CHWA(Y) over the five year planning period is denoted by 1/5 CHWA(·).

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* Default values are described in Appendix E; they are standard values that may be used by libraries lacking the time or resources to make an accurate local estimate.

** The following notation is used here and in Chapter 7. A dot in place of an I indicates summing over all classes of titles; similarly a dot in place of a J indicates summing over all types of records; and a dot in place of a Y indicates summing over the five years of the planning period.

Deleting parameter values equal to zero from the sample that was used to estimate the mean, standard deviation, minimum and maximum of a particular parameter, in effect, removed all runs for alternatives not requiring that particular parameter as input. The reason for this is that the input record for a given run was created by setting equal to zero all the input parameters not required by the particular alternative of that run.

Because of the strong interest in the impact of AACR 2, a cross-product of two input parameters, CHPR(1) and RPH(1), was computed and included among the entries in Table 3.1. This cross product is CHCPH(1); it represents the cost to a library of changing records stemming from a single heading change. See note e of Table 3.1.

3.3 Rejection of Runs Prior to Cost Analysis

The difficulties that stemmed from input parameters having unreasonably large values for certain runs led to the removal of 78 of the 242 runs prior to performing the cost analysis described in the next chapter. The criteria for deleting runs were derived from Table 3.1 and are given in Table 3.2. They are based on the premise that runs containing input parameter values exceeding ten times the mean value should be rejected from the cost analysis.

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Table 3.1
STATISTICAL PROPERTIES OF INPUT PARAMETERS

(242 runs analyzed)

Parameters[a]	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.Dev.	Minimum	Maximum
TN(·, 1)	240	0	-	33,757	16,469	2,500	85,000
TTO(·)	238	0	-	824,876	485,201	61,546	2,662,600
TNMRFS (I)	101	0	-	185,279	183,997	9,500	1,260,659
TW(·,I)	240	0	-	2,725	2,433	190	13,500
CCPT(1)	222	67	17.00	13.21	4.83	4.01	22.00
CEOPT(1)	121	57	0.02	0.025	0.033	0.005	0.351
CECPT(1)	89	41	0.02	0.043	0.061	0.004	0.351
CEMRPT(1)	134	81	0.015	0.735[b]	3.571	0.005	18.800
CCPR(1,1)	111	0	-[c]	1.252	1.089	0.030	4.760
CCPR(1,2)	135	0	-[c]	0.046	0.536	0.050	2.000
CCPR(1,3)	5	0	-[c]	0.144	0.210	0.050	0.520
1/5RC(·,·,·)	116	0	-	10,229	67,717	440	315,478
RCO(·,·)	62	0	-	78,416	158,034	250	1,114,000
CACPT(I)	184	95	0.02	0.096	0.349	0.003	2.60
CRCPC(1)	222	99	2.50	3.135	2.593	.019	20.500
PCTHC(1)	171	83	100	79.180[d]	27.988	5[c]	100
PCTL(1)	141	-	0	59.392	36.136	1	100
CHCPR(1)	224	103	0.325	0.351	0.334	0.100	3.250
CLPH(1)	205	62	0.20	0.296	0.771	0.020	5.000
RPH(1)	207	49	120	78.130	85.953	1.000	358.000
CHCPH(1)[e]	207	32	39.00	22.77	28.11	0.10	189.00
FHCS(I)	233	189	13	12.797	1.447	4.000	20.000
NHC(I,·)	11	0	-	17,340	5,878	9,450	22,221
K(I)	143	14	8	8.036	1.784	5.130	14.00
KN(1)	100	6	8	7.900	2.472	1.000	14.00
CCL(1)	86	50	0.145	0.180	0.116	0.020	0.610
FL	74	0	-	14.531	24.370	0.002	100.00
CN	101	61	0.04	0.040	0.006	0.032	0.076

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Table 3.1 (cont'd)

Parameters	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.Dev.	Minimum	Maximum
CFSPC	101	40	0.125	0.134	0.092	0.039	0.850
CMPC(1)	197	99	0.225	0.290	0.147	0.095	1.17
FM(1)	195	123	1.3	1.174	0.753	0.004	4.000
CPCB	197	3	62,000	57,535	16,384	33,825	94,770
SQPC	178	124	30	28.864	7.168	4.980	56.000
CCAB	92	42	1,925	2,000	388	1,200	3,800
CSQ	130	105	5.00	13.919	25.468	1.90	130.00
CEPC	94	46	90	97.780	100.811	8.00	1,000
PBCE	94	13	3	3.894	1.710	0.500	10.00
NCOMRO	27	0	-	40.815	45.125	5	128
N COMRI(·)	75	0	-	78.333	130.403	1	750
1/5NCO(·)	8	0	-	23.375	28.930	3.2	82
1/5NC(·)	83	0	-	38.942	28.985	1	150
1/5NUO(·)	9	0	-	0.644	0.623	0.200	2
NU	82	0	-	3.549	3.468	1	12
NS	69	0	-	12.906	11.090	1	52
CERPT (1)	83	63	0.05	0.057	0.042	0.005	0.420
CSRPT (1)	75	62	0.01	0.010	0.004	0.005	0.040
CMRPT (1)	80	73	0.03	0.031	0.015	0.013	0.150
NFRPTO (1)	9	5	1	3.028	2.810	1.00	6.75
NSRPTO (1)	6	5	7	4.750	.612	4.50	6.00
LPFRO (1)	9	9	7	7.00	0.00	7.00	7.00
LPSRO 1	9	9	3	3.00	0.00	3.00	3.00
CPRO 1	6	6	0.006, 0.0015	0.005	0.002	0.0015	0.006
LPFO	9	8	16,000	15,422	1,733	10,800	16,000
CPMFO	9	7	1.05, 4.90 (114.00)[f]	41.106	54.694	1.050	114.00
CPCFO	9	6	0.25	0.283	0.243	0.075	0.900
NFRPT (1)	81	68	1	1.593	1.710	1.000	9.000
NSRPT (1)	76	4	7	5.462	1.394	1.000	9.000
LPFR (1)	80	59	7	6.800	0.790	4.500	8.000
LPSR (1)	78	59	3	3.562	1.18	1.000	6.000

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Table 3.1 (cont'd)

Parameters	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.Dev.	Minimum	Maximum
CPR (1)	82	70	0.006, 0.0015	0.007	0.014	0.00	0.110
LPF	83	66	16,000(1400)g	14,896	8,042	87.000	71,808
CPMF	82	68	4.90, 1.05 (0.68)g	3.426	2.029	0.010	7.300
CPCF	83	70	0.25, 0.075 (0.13)g	0.205	0.176	0.003	1.200
CMCOM	86	69	25, 100	92.419	321	25	3,000
CDCOM	67	6	10	31.865	130	0.500	950
CICOM	86	54	815 1,250	889	232	250	1,250
CSPCOM	62	53	125	276	425	10.	1,612
1/5CSP(·)	61	11	15,800	42,000	61,477	675	270,000
CSP(1)	56	11	15,800	47,688	54,322	585	208,000
CSP(2)	44	11	15,800	52,382	62,567	630	236,000
CSP(3)	47	11	15,800	51,891	66,853	675	270,000
CSP(4)	48	11	15,800	53,299	71,126	500	304,000
CSP(5)	49	11	15,800	57,904	76,831	375	338,000
1/5CHWA(·)	71	20	19,000	25,726	22,097	9,940	138,000
CHWA(1)	66	18	95,000	86,699	43,349	230	292,000
CHWA(2)	13	0	0	48,091	21,853	16,000	90,000
CHWA(3)	18	0	0	55,677	36,165	8,000	132,000
CHWA(4)	14	0	0	54,656	57,395	10,000	180,000
CHWA(5)	17	0	0	59,893	68,511	10,000	234,000
1/5C DA(·)	72	36	14,600	19,920	11,298	1,739	58,400
CDA 1	68	35	73,000	63,638	36,578	1,739	216,000
CDA 2	21	0	0	27,115	15,792	1,739	73,000
CDA 3	27	0	0	34,719	22,774	1,739	77,000
CDA 4	22	0	0	29,200	18,118	1,739	73,000
CDA 5	22	0	0	31,564	20,149	1,739	73,000
1/5 CTERM(·)	76	10	60,000	34,808	21,499	2,000	97,800
CTERM (1)	70	8	300,000	117,714	93,310	5,000	300,000
CTERM (2)	49	0	0	26,477	23,932	3,000	130,000
CTERM(3)	50	0	0	25,077	18,925	2,600	728,000

PROVISIONAL DATA: USE WITH CAUTION!

Table 3.1 (cont'd)

Parameters	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.Dev.	Minimum	Maximum
CTERM(4)	48	0	0	24,219	18,840	3,000	83,000
CTERMS(5)	52	0	0	24,488	24,956	2,600	150,000
1/5CDEV(·)	76	25	10,999	31,192	20,997	9,670	78,000
CDEV(1)	71	31	50,000	103,931	91,252	24,350	350,000
CDEV(2)	28	0	0	41,973	24,711	6,000	100,000
CDEV(3)	28	0	0	35,723	24,043	6,000	87,500
CDEB(4)	27	0	0	37,713	23,573	6,000	87,500
CDEBV(5)	27	0	0	49,417	50,039	6,000	200,000
1/5CINO(·)	67	9	3,500	3,700	5,049	400	30,000
CINO(1)	61	9	17,500	14,188	10,381	1,500	60,000
CINO(2)	22	0	0	3,482	8,655	50	30,000
CINO(3)	24	0	0	3,715	8,405	50	30,000
CINO(4)	28	0	0	4,023	8,038	50	30,000
CINO(5)	24	0	0	3,992	8,464	50	30,000
1/5 CEO(·)	44	0	0	30,504	23,653	1,800	73,264
CEO(1)	42	0	0	29,223	21,613	7,600	70,000
CEO(2)	41	0	0	34,876	36,101	8,000	212,000
CEO(3)	42	0	0	30,267	23,322	3,000	72,600
CEO(4)	43	0	0	31,944	24,761	3,000	79,860
CEO(5)	43	0	0	32,764	25,932	3,000	87,860
1/5CHWM(·)	66	9	23,400	18,752	12,160	900	63,048
CHWM(1)	60	9	23,400	18,730	11,616	750	63,048
CHWM(2)	60	9	23,400	19,562	11,509	1,500	63,048
CHWM(3)	63	9	23,400	19,754	11,993	1,500	63,048
CHWM(4)	64	12	23,400	20,254	12,292	1,500	63,048
CHWM(5)	66	9	23,400	20,452	12,417	1,500	63,048
1/5CSWM(·)	72	9	14,040	22,525	16,791	2,400	100,000
CSWM(1)	62	9	14,040	23,224	15,692	2,500	100,000
CSWM(2)	66	9	14,040	23,332	16,387	3,000	100,000
CSWM(3)	68	9	14,040	23,702	16,859	3,000	100,000
CSWM(4)	70	9	14,040	24,271	17,637	3,000	100,000
CSWM(5)	72	9	14,040	25,256	18,461	3,000	100,000
1/5CDBM(·)	36	0	0	14,265	17,170	296	70,000

PROVISIONAL DATA: USE WITH CAUTION!

Table 3.1 (cont'd)

Parameters	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.Dev.	Minimum	Maximum
CDBM(1)	35	0	0	12,639	13,586	176	52,000
CDBM(2)	35	0	0	12,956	15,658	237	60,000
CDBM(3)	36	0	0	15,282	18,895	307	70,000
CDBM(4)	35	0	0	15,501	19,564	355	80,000
CDBM(5)	35	0	0	16,548	21,606	403	90,000
1/5CTTS(·)	181	23	h	1,310	1,664	20	11,666
CTTS(1)	174	57	h	3,627	2,801	100	8,333
CTTS(2)	95	26	h	2,269	2,057	35	10,000
CTTS(3)	61	9	h	1,930	2,802	35	11,666
CTTS(4)	57	0	h	1,780	2,891	35	13,333
CTTS(5)	60	0	h	1,998	3,263	35	15,000
1/5CTPS(·)	182	23	h	802	1,394	12	11,666
CTPS(1)	175	54	h	2,136	2,860	63	32,000
CTPS(2)	105	26	h	1,227	1,476	50	10,000
CTPS(3)	69	0	h	1,060	2,053	50	11,666
CTPS(4)	66	0	h	1,115	2,364	50	13,333
CTPS(5)	69	0	h	1,160	2,587	50	15,000
1/5COU(·)	190	22	h	1,798	3,639	20.000	20,234
COU(1)	183	58	h	2,960	5,759	100	26,695
COU(2)	143	25	h	2,275	3,982	50	21,655
COU(3)	134	25	h	2,083	3,623	50	21,655
COU(4)	129	25	h	2,174	3,750	50	21,655
COU(5)	132	25	h	2,129	3,799	50	21,655
1/5 NSERO(·)	150	54	h	96,490	102,965	6084	750,000
NSERO(1)	148	54	h	129,730	14,395	2000	750,000
NSERO(2)	148	54	h	112,388	136,379	1500	750,000
NSERO(3)	146	54	h	94,103	102,719	500	750,000
NSERO(4)	146	54	h	81,482	85,490	500	750,000
NSERO(5)	147	54	h	74,139	79,576	925	750,000
1/5NSER(·)	222	54	h	94,219	119,865	1000	1,035,600
NSER(1)	221	54	h	74,246	107,562	1000	750,000
NSER(2)	221	54	h	83,321	116751	120	963,000
NSER(3)	222	54	h	96,988	122,488	1000	1,100,000

PROVISIONAL DATA: USE WITH CAUTION!

Table 3.1 (cont'd)

Parameters	Runs with non-zero values	Runs with default values	Default Value	Mean	Std.dev.	Minimum	Maximum
NSER(4)	220	54	h	104,072	132,560	1000	1,240,000
NSAER(5)	222	54	h	109,137	138,278	1000	1,240,000
NECPSO	204	101	1.5	1.847	0.965	1.090	5.390
NECPS	220	103	1.5	1.881	1.117	1.000	6.000
TCEO	210	97	h	70.837	19.857	20	140
TCE	220	161	h	58.147	27.607	15	140
CSTPH	220	74	10.00	8.672	4.153	4.550	29.450
1/5CPRL(·)	22	0	0	-8974	20,251	-33,281	30,000
CPRL 1	16	0	0	-13,013	17,331	-30,723	14,000
CPRL 2	21	0	0	-6,550	26,238	-50,000	50,000
CPRL 3	21	0	0	-7217	26,894	-50,000	50,000
CPRL 4	19	0	0	-10,109	27,155	-50,000	50,000
CPRL 5	16	0	0	-18,612	1,457	-35,941	11,200
1/5CSPR(·)	14	0	0	6,362	5,326	-6,019	11,400
CSPR(1)	11	0	0	4,718	13,057	-30,096	14,000
CSPR(2)	8	0	0	8,850	3,632	3,000	11,400
CSPR(3)	8	0	0	8,850	3,632	3,000	11,400
CSPR(4)	8	0	0	8,850	3,632	3,000	11,400
CSPR(5)	11	0	0	16,459	13,382	3,000	36,750
1/5CED(·)	18	0	0	3,730	13,116	-21,600	18,265
CED(1)	8	0	0	-25,937	51,562	100,000	16,672
CED(2)	9	0	0	22,657	34,691	-12,800	91,325
CED(3)	7	0	0	5,639	14,081	-12,800	21,600
CED(4)	7	0	0	5,043	13,617	-12,800	21,600
CED(5)	10	0	0	26,447	35,422	-12,800	75,000
1/5CMISC(·)	13	0	0	2,178	6,736	-5,300	23,500
CMISC(1)	12	0	0	5,337	6,934	-1,000	23,500
CMISC(2)	6	0	0	3,631	9,977	-3,000	23,500
CMISC(3)	7	0	0	2,881	9,629	-5,000	23,500
CMISC(4)	6	0	0	4,631	10,417	-7,500	23,500
CMISC(5)	6	0	0	1,298	12,237	-10,000	23,500

Notes:

a. A dot in place of an I, J, or Y indicates summation over classes of titles, types of records, and years, respectively.

b. The mean value of 0.735 for CEMRPT(1) drops to 0.035 if the maximum value of 18.80 is removed from the sample; it drops to 0.023 if all values exceeding 0.20 are removed from the sample.

c. The meaning of the index J in CCPR(I,J) was not stable. Sometimes J=1 was associated with shelf list records; sometimes J=1 was associated with OCLC archival tapes. Hence, an appropriate default figure is not given. However, see Appendix E for default figures.

d. Regrettably runs with legitimate values of zero for certain parameters were deleted from the computation of the statistical properties listed in this table; for these parameters the mean and minimum values presented in the table are overestimates.

e. CHCPH(1) is defined here to be the product of CHPR(1) and RPH(1); it is not a model parameter.

f. When retro-filming the old file to produce a fiche catalog, an appropriate estimate of CPMFO is $114.00. See Appendix E.

g. Six of the COM runs used default figures for a microfilm catalog which is based on feet of film rather than fiche. See Appendix E.

h. Default figure depends on the alternative. See Appendix E.

Table 3.2
REJECTION CRITERIA FOR THE COST ANALYSIS

Input Parameter* Exceeds	Run Rejected if Parameter Value
TN(I)	100,000
TTO(I)	4,000,000
CEMRPT	$1.00
CCPR(I,J)	$5.00
CACPT(I)	$1.00
CPCB	100,000
CSQ	$40.00
CEPC	$500.00
CDCOM	$20.00
CSPCOM	$500.00

*Note: An alphabetical listing of parameters and definitions is found in Chapter 6.

CHAPTER 4

ANALYSIS OF LIBRARY CATALOG COSTS FOR VARIOUS ALTERNATIVES

Although the primary goal of the Library Catalog Cost Model Project was to develop a tool that could be used by individual libraries to compare the costs of alternative future catalogs, the computer results for the 68 libraries that submitted input forms provide the basis for the secondary goal of this project — to analyze these results.

This chapter consists of three parts:

1. a statistical analysis of the five year costs generated during the Library Catalog Cost Model Project broken down by alternative, by size of library, and by geographical region;

2. an analysis of the costs for five basic alternatives for a hypothetical library;

3. an analysis of the sensitivity of overall cost to changes in various input parameters.

4.1 Statistical Analysis of Costs by Alternative, Library Size, and Region

The computer runs included in the analysis were restricted in three ways. First, only runs for main libraries were included; runs for branch libraries, combining runs and other non-main runs were excluded. Second, a number of runs were removed from the analysis at the request* of certain participating libraries because some input values were recognized as being suspect. Third, runs with unusually large values for certain input parameters were excluded. (A value more than ten times as large as the standard (default) value was considered unusually large.) The number of runs remaining after exclusions was 164.

4.1.1 Distribution by Catalog Form Alternative

The distribution of the 164 runs by alternatives is shown in Table 4.1. The most commonly considered alternatives are seen to be 1, 3, 4, 5 and 6. Furthermore, alternatives 11 and 12 are essentially the same as alternative 6, and alternative 10 is essentially the same as alternative 5, except that a card or COM backup for the new file is included. (See Table 2.1 for a fuller definition of alternatives.)

*At the September workshop, it was pointed out that the results of several runs were unreasonable because of unreasonable input values. An appeal was made for libraries to review their results and to identify runs with inputs of poor quality that should be withdrawn from the statistical analysis.

Table 4.1
DISTRIBUTION OF RUNS BY ALTERNATIVE

	Alternatives	Number of Runs
1.	Unified card catalog	37
2.	Unified COM catalog	6
3.	Unified online catalog	18
4.	Split catalog: card catalog	30
5.	Split catalog: card/COM	31
6.	Split catalog: card/online	22
7.	Split catalog: COM/card	1
8.	Split catalog: COM/COM	5
9.	Split catalog: COM/online	0
10.	Split catalog: card/COM, card backup	3
11.	Split catalog: card/online, card backup	3
12.	Split catalog: card/online, card backup	8
	Total	164

Table 4.2 presents the five year, non-inflated costs, as computed by the Library Catalog Cost Model, broken down by cost components and alternatives. This analysis was performed using SPSS, and is restricted to the commonly preferred alternatives, viz. 1,3,4,5,6. The cost components printed in Table 4.2 are the sub-total costs for the categories given in Section 2.3. The sub-total costs are part of the normal model results as shown in Table 2.6.

Because different sets of libraries are associated with each alternative, one can not reliably use Table 4.2 to compare the costs of different alternatives. For example, consider the mean cost of cataloging and editing. It appears to be signficantly less for alternative 5 than for the other alternatives. But the cataloging and editing costs at a particular library are almost independent of the form of the catalog selected. This might suggest that the libraries that submitted the 31 runs for alternative 5, on the average, either have lower cataloging costs per title or catalog fewer titles each year. (The analysis of the input parameters described in Chapter 3 reveals that the average cost of cataloging a title was as low as $4.00 at one library and as high as $22.00 at another; thus a five fold variation in cataloging costs can be due to this factor alone).

One can, however, use Table 4.2 to compare the relative magnitudes of the different cost components within each alternative. The reason for this is that the set of libraries associated with a given alternative is, of course, the same for all the cost components. From Table 4.2 it is evident that the largest cost component for all alternatives is the cost of cataloging and editing. This cost, on the average, is approximately 70 percent of the total cost for card catalogs and 55 percent of the total cost for on-line catalogs. The next largest cost is that associated with producing and maintaining the catalog — be it card, COM or on-line. This cost ranges from 14 percent (for the split card catalog) to 27 percent (for the unified on-line catalog) of the total cost. The cost of retrospective conversion can be as large as 12 percent of the total cost in the case of the unified on-line catalog, but for other alternatives is less than 3 percent of the total costs. The cost of catalog usuage by the non-cataloging staff varies from 5 to 9 percent of the total cost and tends to be somewhat lower for on-line catalogs than for card or COM catalogs. Estimates of additional costs due to AACR 2 are not major and range, on the average, between 4 and 7 percent of the total cost. The 7 percent figure is associated with the unified card catalog. Training and orientation costs are among the smallest costs, on the order of 1 percent or less. The cost component "other costs and savings", on the average, is only a fraction of a percent of the total costs but has a negative sign, indicating a saving rather than a cost.

TABLE 4.2
FIVE YEAR NON-INFLATED COSTS FOR ALTERNATIVES 1, 3, 4, 5, 6

(in thousands of dollars)

	1 Unified Card		3 Unified Online		4 Split Card-Card		5 Split Card-COM		6 Split Card-Online	
Number of Runs	37		18		30		31		22	
COST COMPONENTS*	Mean (std. dev.)	% of Total Cost	Mean (std. dev.)	% of Total Cost	Mean (std. dev.)	% of Total Cost	Mean (std. dev.)	% of Total Cost	Mean (std. dev.)	% of Total Cost
Cataloging, Editing	2122 (1780)	69.3	2105 (855)	53.5	2722 (1736)	70.8	1495 (1768)	57.8	2124 (1784)	55.2
Additional AACR-2	209 (303)	6.8	177 (149)	4.5	182 (362)	4.7	88 (153)	3.4	155 (200)	4.0
Card Catalog	514 (414)	16.8	0 0	0	531 (381)	13.8	146 (165)	5.6	138 (147)	3.6
Recon	31 (119)	1.0	482 (494)	12.3	46 (127)	1.1	67 (140)	2.6	88 (129)	2.3
COM Catalog	0 (0)	0	0 (0)	0	0 (0)	0	543 (624)	21.0	0 (0)	0
Online Catalog	0 (0)	0	965 (457)	24.5	0 (0)	0	0 (0)	0	1035 (703)	26.9
Training, Orientation	8 (18)	0.3	20 (17)	0.5	10 (17)	0.2	14 (25)	0.5	39 (45)	1.0
Usage	169 (227)	5.5	196 (579)	5.0	356 (813)	9.3	239 (365)	9.2	284 (792)	7.4
Other	8 (24)	0.3	-14 (76)	-0.3	-1 (58)	-0.03	-3 (18)	-0.1	-10 (46)	-0.3
Total	3061 (2301)	100	3932 (1794)	100	3847 (2388)	100	2588 (2350)	100	3851 (2735)	100

*See section 2.3 and Table 2.6.

4.1.2 Distribution By Library Size

The measure of a library's size selected for this analysis was the projected total number of titles in the library on June 30, 1980. Based on an examination of the distribution of this measure, three categories of library size were considered:

a. fewer than 500,000 titles;
b. between 500,000 and 1,000,000 titles;
c. more than 1,000,000 titles.

Of the 164 runs analyzed, 42 came from libraries with fewer than 500,000 titles, 86 came from libraries with between 500,000 and 1,000,000 titles, and 36 came from libraries with more than 1,000,000 titles.

Table 4.3 presents the results of the statistical analysis of the five year, non-inflated total costs as computed by the Library Catalog Cost Model, broken down by library size and alternative. Each cell in the table contains three numbers:

1. the number of runs falling in the cell (N);
2. the mean value of the cost calculated in these runs;
3. the standard deviation of the cost calculated in these runs.

Again the reader is warned against drawing conclusions concerning the comparative costs of different alternatives; different sets of libraries are associated with different alternatives and comparative costs between different alternatives may be very misleading.

As expected, the mean value of the cost increases with library size for each alternative. Mean costs for the largest libraries are typically 3 to 6 times those for the smallest libraries.

The standard deviations in most cells are almost as large as the mean values, indicating a high degree of variability among the various libraries, even when categorized according to size. This variability stems from the variability in the input parameters used to produce the cost figures. (An analysis of the variability of the input parameters is described in Chapter 3.)

TABLE 4.3
FIVE YEAR TOTAL COSTS AS A FUNCTION OF LIBRARY SIZE FOR ALTERNATIVES 1, 3, 4, 5, 6

(in thousands of dollars)

LIBRARY SIZE Number of titles on 6/30/80	Alternative 1 Unified Card		3 Unified Online		4 Split Card-Card		5 Split Card-COM		6 Split Card-Online	
	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N
0 - 500,000	1263 (1229)	9	1506 (426)	3	1562 (1112)	4	1306 (1645)	10	2062 (954)	6
500,000 - 1,000,000	3189 (1807)	18	4062 (716)	14	3255 (1782)	16	2485 (1516)	11	3567 (1698)	13
1,000,000	4450 (2874)	10	9389 (0)	1	5707 (2426)	10	3984 (3025)	10	8652 (3773)	3
All	3061 (2301)	37	3931 (1794)	18	3847 (2388)	30	2588 (2350)	31	3851 (2735)	22

4.1.3 Distribution By Region

ARL has defined geographical regions in its annual Salary Survey as given in Table 4.4. These five regions were used as a basis for a cost breakdown presented in Table 4.5, using the same format as Table 4.3.

Table 4.5 shows that for all alternatives considered the mean values for the Northeast and South are less than the overall mean value and the mean values for the West are greater than the overall mean value. However, these differences are not statistically significant because of the large standard deviations and small sample sizes in each cell.

It is difficult to draw firm conclusions from Tables 4.2, 4.3 and 4.5 for two reasons. The first reason is the high degree of variability in the values of inputs supplied by the various libraries. This variability arises for a number of reasons:

1. There are actual differences in the cost levels and modes of operation in the different libraries, e.g. one library estimates the average cost of cataloging a title at $4.00, another estimates this cost to be $22.00.

2. There are different degrees of accuracy of the estimates of the various input parameters.

3. There are different interpretations assigned to the certain input parameters by the libraries.

4. There are different preferences regarding what kind of costs (such as direct costs or fully burdened costs) are to be examined.

5. There are different tactics concerning how a particular library prefers to use the cost model. For example, some libraries entered zero values for the intellectual costs associated with cataloging, while most entered reasonable estimates for these costs.

The second reason why it is difficult to draw firm conclusions from Tables 4.2 and 4.5 is the lack of balance in the number of runs submitted by the various libraries. Some libraries submitted a single run for alternative 1; others submitted a single run for alternative 4; others submitted multiple runs for alternative 5, exploring a range of COM catalog options, such as different frequencies of updates, etc. The resulting collection of runs is far removed from the ideal balanced experimental design.

Table 4.4.
GEOGRAPHICAL REGIONS

Region	Sub-region	States Included
Northeast	1. New England	Conn., Me., Mass., N.H., R.I., Vt.,
	2. Middle Atlantic	N.J., N.Y., Pa.
North Central	3. East North Central	Ill., Ind., Mich., Ohio, Wisc.
	4. West North Central	Iowa, Kan., Minn., Mo., Neb., N.Dak., S. Dak.
South	5. East South Central	Ala., Ky., Miss., Tenn.
	6. West South Central	Ark., La., Okla., Texas
	7. South Atlantic	Del., D.C., Fla., Ga., Md., N.C., S.C., Va., W.Va.
West	8. Mountain	Ariz., Colo. Idaho, Nev., Mont., N. Mex., Utah, Wyo.
	9. Pacific	Alaska, Calif., Hawaii, Ore., Wash.
Canada		

TABLE 4.5
FIVE YEAR COSTS AS A FUNCTION OF
REGION FOR ALTERNATIVES 1, 3, 4, 5, 6

(in thousands of dollars)

Geographical Region	Alternative 1 Unified Card		3 Unified Online		4 Split Card-Card		5 Split Card-COM		6 Split Card-Online	
	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N	Mean (std. dev.)	N
Northeast	2886 (1783)	13	2975 (1302)	4	2988 (1716)	9	2116 (890)	6	2446 (1229)	7
Northcentral	2333 (2370)	9	4590 (2852)	6	3718 (2377)	10	1722 (1759)	17	3968 (2383)	8
South	2274 (880)	7	3816 (691)	4	3338 (2010)	6	1504 (0)	1	1544 (0)	1
West	4831 (3357)	7	4138 (1043)	2	6591 (3220)	4	5252 (2809)	7	6234 (3875)	5
Canada	5018 (0)	1	4106 (708)	2	4946 (0)	1	- -	0	3132 (0)	1
All	3061 (2301)	37	3932 (1794)	18	3847 (2388)	30	2588 (2350)	31	3851 (2735)	22

4.2 Cost Analysis of Five Basic Alternatives for a Hypothetical Library

Sharper distinctions among the costs for different alternatives can be made by focusing attention on an individual hypothetical library. This removes from the analysis the confounding influences of different library sizes, different costing philosophies, and different interpretations of cost parameters, and one can obtain a clearer impression of how the cost of one alternative compares with that of another.

An attempt was made to characterize a hypothetical library that was representative of the libraries participating in this project. This was done by constructing a set of input parameters for each alternative that characterize the hypothetical library. For those input parameters that characterize a particular library and do not vary with the alternative, values were set approximately equal to the mean value of the parameter. (Mean values and other properties of the distribution of each input parameter are developed in Chapter 3.) For example, in the representative library the number of titles is 825,000, the number of titles newly cataloged each year is 34,000, and the average cost of cataloging a title is $13.21; those numbers are approximately equal to the mean values of these parameters, computed as described in Chapter 3. For those input parameters that vary with the alternative, a different procedure was used: input forms submitted by three libraries with characteristics close to the representative one, as well as the mean values from Chapter 3, were studied and used to guide the final selection of the input parameter values.

Table 4.6 presents a set of input parameter values that characterize the hypothetical library for the five basic alternatives. (These parameters are defined in Table 2.4.) Because Table 4.6 was derived in large part from the data presented in Figure 3.1, it too must be regarded as provisional in nature and may in fact not truly represent any individual library. It is not a substitute for locally developed estimates. Furthermore, some of the costs, such as retrospective conversion costs in alternatives 5 and 6, could be excluded if the least costly approach is desired. Table 4.6, therefore, should be regarded as illustrative only.

Table 4.6

PARAMETER VALUES FOR THE HYPOTHETICAL LIBRARY

A. Parameters Held Constant over all Alternatives Considered

NCT	= 1 (I = 1: all titles)
NRT	= 2 (J = 1: shelf list records, J = 2: OCLC tapes)
TN(1,Y)	= 34,000, Y = 1, 2, 3, 4, 5
TTO(1)	= 825,000
TW(1,Y)	= 2,700, Y = 1, 2, 3, 4, 5
CCPT(1)	= $13.21
CEOPT(1)	= $0.025
CECPT(1)	= $0.025
CEMRPT(1)	= $0.020
CCPR(1,1)	= $1.25
CCPR(1,2)	= $0.05
CACPT(1)	= 0.02
CRCPC(1)	= $3.14
CHCPR(1)	= $0.35
CLPH(1)	= $0.30
RPH(1)	= 79
FHCS(1)	= 13
K(1)	= 8
KN(1)	= 8
CCL(I)	= 0.18
FL	= 14
CN	= $0.04
CMPC(1)	= 0.15
FM(1)	= 1.2
CPCB	= 58,000
SQPC	= 29
CCAB	= $2000.00
CSQ	= $5.00
CEPC	= $98.00
PBCE	= 4
NCOMRI(0)	= 40
NCOMRI(Y)	= 16, Y = 1, 2, 3, 4, 5
NC(Y)	= 23, Y = 1, 2, 3, 4, 5
NU	= 4
NS	= 12
TSPO(1)	= 0
CERPT(1)	= 0.06
CSRPT(1)	= 0.01
NFRPT(1)	= 1.6
NSRPT(1)	= 5.5
LPFR(1)	= 6.8
LPSR(1)	= 3.6
CPR(1)	= 0.007
LPF	= 15,000
CPMF	= 3.43

(Note: An alphabetical listing of parameters and definitions is found in Chapter 6.)

CPCF	= 0.21
COR	= 0
CMCOM	=$25
CDCOM	=$2
CICOM	= $889
CSPCOM	= $276
NECPSO	= 1.8
NECPS	= 1.8
CSTPH	= $8.67
CPRL(Y)	= 0, all Y
CSPR(Y)	= 0, all Y
CED(Y)	= 0, all Y
CMIS	= 0, all Y

B. Parameters for Alternative 1: Unified Card

CRSPC	= 0.13*
RC(I,J,Y)	= 0, for all J, Y
RCO(1,J)	= 0, for all J
PCTHC(1)	= 100
PCTL(1)	= 0
CTTS(Y)	= $500, all Y
CTPS(Y)	= $500, all Y
COU(Y)	= $1000, all Y
NSERO(Y)	= 0, all Y
NSER(Y)	= 100,000, all Y
TCEO	= 70
TCE	= 70

C. Parameters for Alternative 3: Unified On-line

RC(1, 1, Y)	= 640,000,	Y = 1
	= 0,	Y = 2, 3, 4, 5
RC(1,2,Y)	= 185,000	Y = 1
	= 0,	Y = 2, 3, 4, 5
PCTHC(1)	= 100	
PCTL(1)	= 0	
RCO(1,1)	= 0	
RCO(1,2)	= 0	
CSP(Y)	= 42,000, for Y = 1, 2, 3, 4, 5	
CHWA(Y)	= 300,000, for Y = 1	
	= 0, for Y = 2, 3, 4, 5	
CDA(Y)	= 200,000, for Y = 1	
	= 0, Y = 2, 3, 4, 5	
CTERM(Y)	= 118,000, for Y = 1	
	= 14,000, for Y = 2, 3, 4, 5	
CDEV(Y)	= 350,000, for Y = 1	
	= 0, for Y = 2, 3, 4, 5	
CINO(Y)	= 25,000, for Y = 1	
	= 300, Y = 2, 3, 4, 5	

CEO(Y)	= 30,000, for all Y
CHWM(Y)	= 50,000, for all Y
CSWM(Y)	= 50,000, for all Y
CDBM(Y)	= 30,000, for all Y
CCRENT(Y)	= 0, for all Y
CTTS(Y)	= 5000 4000 2000 1000 500
CTPS(Y)	= 3000 2000 1500 500 500
COU(Y)	= 2000 1500 1000 500 500
NSERO(Y)	= 0, for all Y
NSER(Y)	= 100,000, for all Y
TCEO	= 20
TCE	= 20

D. Parameters for Alternative 4: Split Card/Card

RC(1,1,Y)	=0, for all Y
RC(1,2,Y)	= 0, for all Y
RCO(1,1)	= 0
RCO(1,2,	= 0
PCTHC(1)	= 25
PCTL(1)	= 75
CFSPC	= $0.072*
CTTS(Y)	= $1000, for all Y
CTPS(Y)	= $500, for all Y
COU(Y)	= $1000, for all Y
NSERO(Y)	= 83,000 72,000 67,000 64,000 61,000 Y = 1 to 5
NSER(Y)	= 17,000 28,000 33,000 36,000 39,000 Y = 1 to 5
TCEO	= 70
TCE	= 70

E. Parameters for Alternative 5: Split Card/COM

RC(1,1,Y)	= 5000, for all Y
RC(1,2,1)	= 185,000
RC(1,2,Y)	= 0, Y = 2, 3, 4, 5
RCO(1,J)	= 0, J = 1, 2
PCTHC(1)	= 25
PCTL(1)	= 75
CTTS(Y)	= 5000 4000 2000 1000 500
CTPS(Y)	= 3000 2000 1500 500 500
COU(Y)	= 2000 1500 1000 500 500
NSERO(Y)	= 83,000 72,000 67,000 64,000 61,000 Y = 1 to 5
NSER(Y)	= 17,000 28,000 33,000 36,000 39,000 Y = 1 to 5
TCEO	= 70
TCE	= 80

F. Parameters for Alternative 6: Split Card/On-line

PCTHC(1)	= 25
PCTL(1)	= 75

RC(I,J,Y)	= 0, Y = 2, 3, 4, 5					
RCO(I,J,Y)	= 0, J = 1, 2					
CSP(Y)	= 42,000, for all Y					
CHWA(Y)	= 150,000, Y = 1					
	= 0, Y = 2, 3, 4, 5					
CDA(Y)	= 150,000, Y = 1					
	= 0, Y = 1					
CTERM(Y)	= 118,000, Y = 1					
	= 14,000, Y = 2, 3, 4, 5					
CDEV(Y)	= 200,000, Y = 1					
	= 0, Y = 2, 3, 4, 5					
CINO(Y)	= 20,000, Y = 1					
	= 300, Y = 2, 3, 4, 5					
CEO(Y)	= 20,000, for all Y					
CHWM(Y)	= 25,000, for all Y					
CSWM(Y)	= 30,000, for all Y					
CDBM(Y)	= 15,000, for all Y					
CCRENT(Y)	= 0, for all Y					
CTTS(Y)	= 5000	4000	2000	1000	500	
CTPS(Y)	= 3000	2000	1500	500	500	
COU(Y)	= 2000	1500	1000	500	500	
NSERO(Y)	= 83,000	72,000	67,000	64,000	61,000	Y = 1 to 5
NSER(Y)	= 17,000	28,000	33,000	36,000	39,000	Y = 1 to 5
TCEO	= 70					
TCE	= 20					

*The average cost of sorting and filing per card was assumed to be greater for the unified card catalog (13¢) than for the split catalog (7.2¢). The cost figure for the split catalog was derived from the unified figure under these assumptions:

1. the sorting cost accounts for 10% of the cost of sorting and filing
2. the sorting cost is the same for both the unified and split catalogs
3. the filing cost for the split catalog is half that for the unified catalog.

Using the complete set of input parameter values as a basis, five year uninflated total costs were computed for alternatives 1, 3, 4, 5 and 6 using the Library Catalog Cost Model. The results of this computation are shown in Table 4.7 and Figure 4.1.

Table 4.7 reveals that for the hypothetical library specified in Table 4.6, five year uninflated costs range from 3.1 to 5.7 million dollars. The least costly alternative is the split card catalog with a cost of 3.1 million dollars. The unified card catalog is the next least costly at 3.4 million dollars. The split card COM catalog is next least costly at 3.7 million dollars. The online catalogs are the most costly alternatives at 4.3 million dollars for the split card online catalog and 5.7 million dollars for the unified online catalog.

The above ranking of alternatives by cost is illustrative only. Only if an individual library has the set of parameter values given in Table 4.6, would the costs of Table 4.7 apply. One can not draw general conclusions that hold for all libraries from Table 4.7. Particularly variable are the costs for the split card/COM catalog where many options are available, such as whether an in-house facility exists for producing the COM catalog, how frequently the entire COM catalog is updated, how many copies of the catalog are required, the average length of the records in the catalog, etc.

Figure 4.1 shows the uninflated annual costs to the hypothetical library of the five alternatives plotted over the five year planning period. The two online alternatives, 3 and 6, are characterized by the very large one time cost in 1981 stemming from the cost of developing, acquiring and installing the online system. In subsequent years the online alternative costs are nearly constant. The pure card alternatives, 1 and 4, are nearly constant over the entire period. The somewhat smaller costs in fiscal 1981 stem from the smaller AACR 2 costs which are incurred during only six months (January 1, 1981 to June 30, 1981) rather than twelve months, which is the case for the other fiscal years. The split card/COM alternative (alternative 5) differs from the others in that its annual costs increase steadily from year to year. By 1983 the annual costs of this alternative surpass those of alternative 6 and by 1985 are approaching those of alternative 3. Had a longer planning period been selected, the annual costs of alternative 5 would probably have surpassed those of the other alternatives.

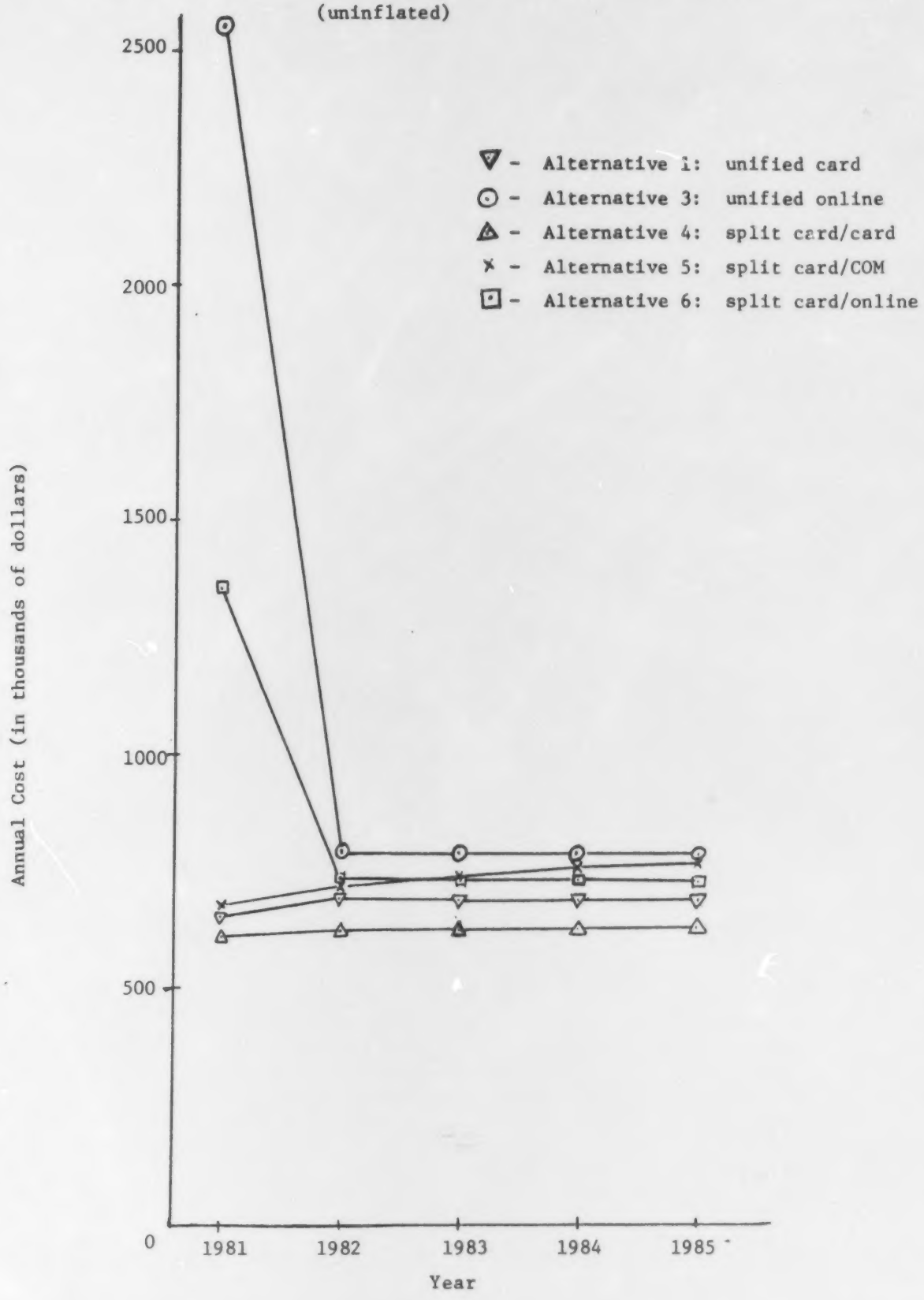
Again the reader is cautioned not to draw general conclusions from Figure 4.1, which is illustrative only. Only if an individual library is described by the parameters of Table 4.6 can it expect its costs to behave as shown in Figure 4.1.

TABLE 4.7
FIVE YEAR NON-INFLATED COSTS OF A HYPOTHETICAL
LIBRARY FOR ALTERNATIVES 1, 3, 4, 5, 6

(in thousands of dollars)

	Alternative									
	1 Unified Card		3 Unified Online		4 Split Card-Card		5 Split Card-COM		6 Split Card-Online	
	Cost	% of Total Cost	Cost	% of Total Cost	Cost	% of Total Cost	Cost	% of Total Cost	Cost	% of Total Cost
Cataloging, Editing	2449	71.5	2426	42.5	2449	78.8	2464	67.4	2464	57.8
Additional AACR-2	338	9.9	338	5.9	113	3.6	113	3.1	113	2.7
Card Catalog	475	13.9	0	0.0	383	12.3	144	3.9	144	3.4
RECON	0	0.0	809	14.2	0	0.0	41	1.1	41	0.9
COM Catalog	0	0.0	0	0.0	0	0.0	710	19.4	0	0.0
Online Catalog	0	0.0	2060	36.1	0	0.0	0	0.0	1355	31.8
Training, Orientation	10	0.3	26	0.5	13	0.4	26	0.7	26	0.6
Usage	152	4.4	43	0.8	152	4.9	158	4.3	119	2.8
Other	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	3424	100	5703	100	3109	100	3655	100	4260	100

FIGURE 4.1
TOTAL ANNUAL COST VERSUS YEAR FOR A HYPOTHETICAL LIBRARY
(uninflated)



4.3 Sensitivity Analysis: Example

The various input parameters required by Library Catalog Cost Model have different degrees of impact on the costs generated by the model, which raises a number of questions:

1. Which input parameters are most critical?
2. How accurate should the estimates of the various input parameters be?
3. What is the impact on the total cost of inaccuracies of certain input parameters?

Although it is beyond the scope of this project to answer these questions fully, we can gain considerable insight into these questions by determining the sensitivity of the total cost to changes in selected input parameters, i.e., by conducting a sensitivity analysis.

The Library Catalog Cost Model is a convenient tool for conducting such an analysis. The first step is to choose a point of reference or base case and use the model to compute the total cost associated with it. The next step is to change the value of an input parameter of interest and use the model to recompute the total cost associated with this deviation from the base case. The change in total cost associated with the change in input parameter value shows us the sensitivity of total cost to that parameter.

The sensitivity analysis described here uses alternatives 4 and 5 of the hypothetical library of section 4.2 as base cases. Alternative 4 involves most of the input parameters of interest for a card catalog. Alternative 5 was included to permit the analysis of input parameters that describe a COM catalog. For each base case, selected input parameters were increased by ten percent from the base case value, and the cost model was used to compute the associated cost.

The percent increase in the total cost associated with the ten percent increase in input parameter value is presented in Table 4.8 for several selected input parameters. The parameters have been listed in decreasing order of sensitivity under each base case. The most sensitive parameter by far is the average cost of cataloging per title. The base case value of this parameter is $13.21. Increasing it by ten percent (to $14.53) increases the total cost for the representative library by 7.22 percent (from $3,108,596 to $3,333,166). For the COM catalog alternative the number of updates per year, NU, is seen to be one of the more sensitive parameters; a ten percent increase in this parameter increases the total cost for the representative library by one percent. The sensitivities of the remaining parameters listed in Table 4.8 may be interpreted similarly.

Table 4.8

SENSITIVITY OF THE FIVE YEAR TOTAL UNINFLATED COST TO A 10 PERCENT INCREASE IN SELECTED INPUT PARAMETERS (HYPOTHETICAL LIBRARY)

Parameter	Percent Change in Total Cost
Base Case: Alternative 4, Split Card/Card	
Average cost of cataloging a title (CCPT)	7.22
Average number of cards for a newly cataloged title (KN)	0.77
Average number of cards per title in old file (K)	0.46
Average cost of editing per title in the old file (CEOPT)	0.33
Average number of records requiring change per heading change (RPH)	0.24
Average cost of making a heading change per record (CHCPR)	0.24
Average cost of sorting and filing per card (CSFPC)	0.12
Average cost of resolving a conflict (CRCPC)	0.11
Average cost of creating a link for a heading conflict (CLPH)	0.008
Base Case: Alternative 5, Split Card/COM	
Number of updates per year of the entire COM catalog (NU)	1.00
Average number of short records in the COM catalog per title (NSRPT)	0.88
Average number of full records in the COM cataog per title (NFRPT)	0.32
Number of copies of the COM catalog produced (NC)	0.29

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary and Conclusions

1. A model has been developed and used by 68 individual libraries to compare the cost of alternative future forms of the catalog, emphasizing the costs of AACR 2 implementation. The software for implementing the model (an interactive program written in FORTRAN and documented elsewhere) has been obtained by 42 project participants and is now operational at many individual libraries.

2. Analysis of model input parameters provided by individual libraries indicated a high degree of variability in many of the input parameters. This variability apparently stems from these sources:

   a. actual differences in the cost levels and modes of operation at different individual libraries;
   b. different degrees of accuracy of the estimates of the various input parameters;
   c. different interpretation assigned to certain parameters by different individual libraries;
   d. different preferences regarding what kind of costs (such as direct costs or fully burdened costs) are to be examined;
   e. different tactics concerning how an individual library prefers to use the cost model.

   The second and third sources of variability are a direct consequence of the time constraints imposed on this project (approximately two months for model development and six weeks for both data collection and input parameter estimation). Additional time and effort probably could reduce the variability stemming from these sources to a negligible level. A generally accepted standardized costing procedure would be required to eliminate the variability from the fourth and fifth sources.

3. Analysis of costs determined by the model for the individual libraries also indicated a high degree of variability. Although attempts (including categorization of libraries by size and geographic region) to draw general conclusions regarding which alternative form of the catalog was least costly were not successful, the following statements appear to hold.

   a. The cost of preparing catalog records is the dominant cost of developing and maintaining a catalog, regardless of the forms of the catalog.
   b. The estimated cost of AACR 2 implementation, in most instances, accounts for less than ten percent of the cost of developing and maintaining a catalog.

4. The Library Catalog Cost Model has been found to be a useful tool by many individual libraries for evaluating both alternative future forms of the catalog and proposed ways of treating AACR 2 implementation. For example, the model can estimate the cost of producing COM catalogs for any number of update frequencies (weekly, monthly, etc.) and can estimate the cost of AACR 2 implementation for different options (change headings, create links, etc.). Sections 4.2 and 4.3 illustrate how the model may be applied for estimating the costs of different future alternatives and for conducting sensitivity analyses. One participant applied the equations of model manually, using a desk-top calculator, to examine the effect of changing selected input parameters on the associated component costs. This method of applying the model, though more time consuming than using the computer program, leads to a more thorough understanding of the model and its parameters.

5. The model also can be a very useful tool in planning, budgeting, and staffing work at an individual library long after its value in addressing AACR 2 and form of the catalog has ceased. The model may also be regarded as a prototype which could be modified to project costs to other library operations, especially acquisitions.

5.2 Recommendations for Future Model Development

Although the Library Catalog Cost Model has been used successfully by many libraries the model can be improved in a number of ways. The compressed time schedule under which the model was developed precluded the incorporation of the improvements suggested here in the version of the model described in this report. If the model is further developed, the following improvements should be included in revised versions of the model.

1. Incorporate the results of additional research into the costs of on-line catalog and the costs of AACR 2 implementation more fully into future versions of the model. The underlying processes and parameters that give rise to these costs are not as well understood as the costs associated with card and COM catalogs. The processes that govern the number of records affected by AACR 2 implementation, particularly over long periods of time, are only partially understood at this time.

2. Generalize the current model to remove the following limitations:

   a. The time of changeover from one form of the catalog to another should be permitted to occur at any time in the planning period, and should be allowed to occur gradually.

   b. The planning period should be an optional input; a user may prefer to consider a planning period of 10 years instead of 5.

3. Modify the method of inputting labor cost parameters so that they are broken down by the time to perform certain functions and the associated hourly costs. The current version of the model relies on costs per

function, which are highly variable because of variant labor costs. One would expect the time estimates for different libraries to be more stable, both geographically and temporally, than unit costs.

4. Facilitate the treatment of various options by making the following changes:

   a. Account for the possibility of withdrawing a title from the new file.
   b. Explicitly account for the cost of withdrawing a title from the library.
   c. Distinguish between the old (AACR 1) and the new (AACR 2) machine readable files, and allow retrospective conversion of titles into either. Also allow for conversion from the old machine readable file to the new. This would be desirable particularly if one wanted to change an old card file to an old COM file and work eventually to a unified COM file.
   d. Account for the reduction in cost of card operation as a result of retrospective conversion of the old card records to machine readable records.
   e. For alternatives based on a new machine readable file, explicitly account for the fact that cards may still be produced, stored, and maintained for some of the titles. (This can be treated with the current model by means of combining runs.)
   f. For alternatives based on a new card file, where cards are produced through a utility, explicitly account for the fact that the machine readable file must be maintained. (This can be treated with the current model by means of combining runs.)
   g. Relate authority control costs to the number of unique headings instead of the number of titles as is currently done.
   h. Restructure card catalog cabinet and expansion costs to reflect actual year by year expenditures. (The current model smooths these expenditures over a number of years and provides average annual expenditures only.)
   i. Clarify the distinction between filmed and COM catalogs.
   j. Separate the components of catalog usage by the library staff into: use of the old file, use of the new file, total use.
   k. Account for the fact that a new COM catalog exists for only six months instead of a year during fiscal 1981.
   l. When the old file is closed, account for the possible transfer of records from the old file to the new.
   m. Permit the production and use of COM catalogs at a library simultaneously in both microfilm and microfiche forms. (The current model allows either microfilm or microfiche but not both; a combining run would be required to treat them both.)

5. Conduct a more complete sensitivity analysis and use it to identify the more sensitive input parameters and the less sensitive input parameters

6. Strive to improve the accuracy of the more sensitive input parameters.

7. Consider simplifying the model by removing the less sensitive input parameters.

8. The format of the computer produced output of the model should be reviewed and improved to meet additional needs of users.

9. Strive to clarify ambiguous input parameter definitions, recognizing, however, that for a parameter to be sufficiently flexible to characterize the modes of operation of many different libraries, its definition may be limited in its specificity.

PART II

LIBRARY CATALOG COST MODEL EQUATIONS AND DEFINITIONS

The purpose of Part II is to develop equations for estimating the output elements of the Library Catalog Cost Model, defined in Table 2.2. Definitions of all parameters required by these equations are given in Chapter 6; the equations are described in Chapter 7.

CHAPTER 6

DEFINITIONS OF PARAMETERS

This chapter consists of an alphabetized list of definitions of terms appearing in the equations of Chapter 7. Many of the parameters defined in this list are functions of one or more of the indexes I, J and Y. The index I permits one to distinguished among different classes of titles, e.g. I=1 denotes monographs, I=2 denotes serials, etc. The index J permits one to distinguish among different types of bibliographic records used as a basis for retrospective conversion, e.g. J=1 denotes shelf list cards, J=2 denotes OCLC tapes, etc. The index Y permits one to distinguish among different fiscal years; Y=1 denotes fiscal year 1981 (July 1, 1980 to June 30, 1981), Y=2 denotes fiscal year 1982, etc., and Y=5 denotes fiscal year 1985. In general a parameter indexed with Y applies for Y=1, 2, 3, 4, and 5. In a few instances it is convenient to define a parameter with Y=0 to account for behavior prior to fiscal 1981; where this is done the definition is spelled out.

The following definitions describe the parameters required to compute the cost, and other output elements defined in Chapter 2 (Table 2.2) for a particular alternative and a particular library.

ALT	Alternative whose cost is to be estimated. (See Table 2.1.)
ATNCF(I,1)	Average number of titles in the new card file during the six month period January 1 to June 30, 1981.
ATNCF(I,Y)	Average number of titles in the new card file during year Y.
ATNMRF(I,1)	Average number of titles in the new machine readable file during the six month period January 1 to June 30, 1981.
ATNMRF(I,Y)	Average number of titles in the new machine readable file during year Y.
ATT(I,Y)	Average number of titles of class I in the library and in the unified file during year Y.
ATTS(I,Y)	Average number of titles of class I in the old file during year Y.
C(Y)	A cost component in fiscal year Y expressed in January 1, 1980 dollars.
CAC(I,Y)	Cost of maintaining authority file in year Y for titles of class I. (Does not include cost of authority work done during cataloging.)
CACPT(I)	Average cost of maintaining authority file per title of class I. (Does not include cost of authority work done during cataloging.)

CC(I,Y)	Cost of preparing catalog records for titles of class I in year Y.
CCAB	Average cost of acquiring a card cabinet.
CCE(Y)	Labor cost of catalog expansion for the unified card file in year Y.
CCEN(Y)	Labor cost of catalog expansion for the new card file in year Y.
CCFPT(I)	Cost of producing copy fiche (or copy film) per title of class I in the COM catalog or the new or unified file.
CCFPTO(I)	Cost of producing copy fiche (or copy film) per title of class I in the COM (or other microform) catalog of the old file.
CCL(I)	Average cost of producing a catalog card locally for class I titles.
CCOMD(Y)	Cost of delivering copies of the COM catalog of the new or unified file in year Y.
CCOMDO(Y)	Cost of delivering copies of the COM catalog of the old file in year Y.
CCOMI(Y)	Cost of installing microform readers in year Y.
CCOMM(Y)	Cost of maintaining microform readers in year Y.
CCOMN(I,Y)	Contribution to the cost of producing COM catalogs of the new file in year Y made by class I titles.
CCOMO(I,Y)	Contribution to the cost of producing COM (or other microform) catalogs of the old file in year Y made by class I titles.
CCOMSP(Y)	Cost of space for microform readers in year Y.
CCOMU(I,Y)	Contribution to the annual cost of producing COM catalogs of the unified file in year Y made by class I titles.
CCOPMN(Y)	Cost of operation and maintenance of on-line system in year Y.
CCPR(I,J)	Cost of creating a machine readable record suitable for producing a COM or on-line catalog for a title of class I from a record of type J.
CCPT(I)	Average cost of cataloging a title of class I. This cost encompasses the intellectual work of cataloging including pre-catalog searching, authority checking, etc. The average figure includes all types of cataloging, e.g., original

cataloging, cataloging with LC copy, and cataloging when shared copy is available. This cost includes the cost of using the cataloging data base maintained by a bibliographic utility, but does not include the cost of maintaining a separate newly created data base to generate a public COM or on-line catalog.

CCRENT(Y) Cost of computer rental in year Y.

CDA(Y) Cost of acquiring disk drives in year Y.

CDBM(Y) Cost of data base maintenance in year Y.

CDCOM Average cost of delivering a COM catalog and preparing it for display.

CDSNF(·,Y) Average value during year Y of the total number of cards in the new card file.

CDSNF(I,Y) Average number of cards in the new file for titles of class I during year Y.

CDSOF(·,Y) Average value during year Y of the total number of cards in the old file.

CDSOF(I,Y) Average number of cards in the old file for titles of class I during year Y.

CECPT(I) Annual cost of editing the new or unified card file per title of class I in the file.

CED(Y) Costs (or savings) from equipment disposition in year Y. Input.

CEMRPT(I) Annual cost of editing the new or unified machine readable file per title of class I in the file.

CENCF(Y) Cost of editing the new card file in year Y.

CENMRF(Y) Cost of editing the new machine readable file in year Y.

CEO(Y) Cost of equipment operators in year Y.

CEOF(Y) Cost of editing the old file in year Y.

CEOPT(I) Annual cost of editing the old file per title of class I in the old file. This is the cost of intellectual work, not the physical maintenance.

CEPC Labor cost of catalog expansion divided by the number of cabinets at the time of expansion.

CER(Y)	Cost in year Y of entering and creating machine readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records, for newly cataloged titles. This includes the cost of converting catalog records into a form suitable for producing a COM catalog.
CERPT(I)	Average cost per newly cataloged title of class I of entering and creating machine readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records.
CEUCF(Y)	Cost of editing the unified card file in year Y.
CEUMRF(Y)	Cost of editing the unified machine readable file in year Y.
CFSPC	Cost of sorting and filing per card. This includes the cost of both manually produced and utility produced cards, and the cost of filing revision.
CH(Y)	Cost of the floor space in year Y for the card catalog of the unified file.
CHC(I,Y)	Cost in year Y of making heading changes for titles of class I.
CHCPR(I)	Average cost of making a heading change on an existing bibliographic record of a class I title.
CHNF(Y)	Cost of the floor space in year Y for the card catalog of the new file.
CHOF(Y)	Cost of the floor space in year Y for the card catalog of the old file.
CHROA(Y)	Cost of hardware rental or acquisition in year Y.
CHWA(Y)	Cost of acquiring computer processing hardware (CPU, console, tape drive, etc.) in year Y.
CHWM(Y)	Cost of hardware maintenance in year Y.
CI(Y)	The inflated cost corresponding to C(Y).
CICOM	Cost of acquiring and installing a microform reader.
CINO(Y)	Cost of installing the on-line system in year Y.
CL(I,Y)	Cost in year Y of providing linkages to resolve heading conflicts resulting from AACR 2 for titles of class I.
CLPH(I)	Average cost of producing linkages, interfilings, etc. per heading conflict treated for class I titles.

CM(Y)	Cost of maintaining the unified card catalog during year Y. This includes the cost of pulling, physical change, refiling, etc., excluding the impact of AACR 2.
CMCOM	Average cost per year of maintaining a microform reader.
CMFPT(I)	Cost of producing master fiche (or master film) per class I title in the COM catalog of the new or unified file.
CMFPTO(I)	Cost of producing master fiche (or master film) per class I title in the COM or other microform catalog of the old file.
CMISC(Y)	Miscellaneous costs in year Y. These costs account for possible omissions in the other cost categories. Input.
CMN(Y)	Cost of maintaining the card catalog of the new file during year Y.
CMO(Y)	Cost of maintaining the card catalog of the old file during year Y.
CMPC(I)	Average cost of pulling, changing, refiling and revision per card treated for class I titles.
CMR(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the unified file in year Y.
CMRN(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the new file in year Y.
CMRO(Y)	Cost of maintaining machine readable records suitable for producing a COM catalog of the old file in year Y.
CMRPT(I)	Average cost per title of class I of maintaining machine readable records. This includes the cost of keying corrections, making deletions, etc., excluding the impact of AACR 2. (This does not include the intellectual work of editing.)
CN	Average cost of producing a catalog card by means of a utility.
CNC(Y)	Cost of acquiring new card cabinets in year Y.
COMN(Y)	Cost in year Y of producing COM catalogs for the new file.
COMO(Y)	Cost in year Y of producing COM (or filmed) catalogs for the old file.

COMU(Y)	Cost in year Y of producing COM catalogs for the unified file.
COR	A correction factor for the cost of producing the COM catalog of the new or unified file.
CORO	A correction factor for the cost of producing the COM catalogs of the old file. This factor corrects for costs which are not proportional to the number of titles in the catalog.
COU(Y)	Cost of orienting users concerning changes in the catalog in year Y, including cost of labor and materials.
CPC(Y)	Cost of producing cards for titles newly cataloged during year Y.
CPCB	Average number of cards per cabinet.
CPCF	Cost per copy fiche (or cost per foot of copy film) for the COM catalog of the new or unified file.
CPCFO	Cost per copy fiche (or cost per foot of copy film) for the microform catalog of the old file.
CPMF	Cost per master fiche (or cost per foot of master film) for catalog of the new file.
CPMFO	Cost per master fiche (or cost per foot of master film) for catalog of the old file.
CPPT(I)	Computer processing cost per title of class I in the COM catalog of the new or unified file.
CPPTO(I)	Computer processing cost per title of class I in the COM or other microform catalog of the old file.
CPR(I)	Cost for processing a record of a class I title to produce a COM catalog of the new or unified file.
CPRL(Y)	Costs (or savings) from personnel reallocation in year Y.
CPRO(I)	Cost of processing a record of a class I title to produce a COM (or filmed) catalog of the old file.
CPT(I,Y)	Cost per class I title for NC(Y) copies of a single version of the COM catalog of the new or unified file in year Y.
CRC(I,J,Y)	Cost of creating machine readable (or microform) records suitable for producing a COM, filmed, or on-line catalog for titles of class I during fiscal year Y from records of type J. For example, a conversion might be based on two types of records: OCLC archival records (J=1), and shelflist cards (J=2). Other possibilities exist.

CRCPC(I)	Average cost of intellectual work required to resolve a heading conflict resulting from AACR 2 for a title of class I.
CRECON(Y)	Cost in year Y of creating machine readable records suitable for producing a COM or on-line catalog.
CRHC(I,Y)	Cost of resolving heading conflicts resulting from AACR 2 for titles of class I during year Y.
CS(Y)	Cost of searches using catalog by non-cataloging staff in year Y.
CSF(Y)	Cost of sorting and filing catalog cards in year Y.
CSP(Y)	Cost of space associated with the on-line catalog in year Y.
CSPCOM	Cost per year of space for one microform reader.
CSPR(Y)	Costs (or savings) from space reassignment in year Y.
CSQ	Cost per square foot of floor space where catalog is housed; e.g., rental cost if applicable.
CSR(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the unified file in year Y.
CSRN(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the new file in year Y.
CSRO(Y)	Cost of storing machine readable records suitable for producing a COM catalog of the old file in year Y.
CSRPT(I)	Average annual cost per title of class I of storing machine readable records suitable for creating the COM catalog.
CSTPH	Average cost for one hour of a staff member's time. The average is derived from all non-cataloging staff using the catalog.
CSWM(Y)	Cost of software maintenance in year Y.
CTERM(Y)	Cost of acquiring terminals in year Y.
CTPS(Y)	Cost of training public services staff concerning changes in the form of the catalog in year Y, including cost of labor and materials.
CTTS(Y)	Cost of training technical services staff concerning changes in form of the catalog in year Y, including cost of labor and materials.

DOS	Date of submission of run.
DR	Real discount rate (percent).
FHC(I,Y)	Percentage of headings of class I titles in the existing catalog that are in conflict with AACR 2 and not yet treated on June 30 of year Y.
FHCN(I,Y)	Percentage of headings of class I titles newly cataloged in year Y in conflict with existing catalog headings.
FHCS(I)	Percentage of headings of class I titles in the existing catalog that are in conflict with AACR 2 on January 1, 1981.
FL	Percent of catalog cards produced locally. (The remainder are assumed to be produced by a utility.)
FM(I)	Percent of cards for titles of class I requiring pulling, changing, refiling, etc., excluding the impact of AACR 2.
HN(I,Y)	Number of headings new to the catalog associated with titles of class I added to the library during fiscal year Y. Where appropriate, these are additions to the authority file in year Y. (Does not include new forms for existing headings in the catalog.)
HT(I,Y)	Total number of headings associated with titles of class I that are in the library on June 30 of year Y. Where appropriate, this is equal to the number of headings in the authority file (excluding topical subjects). For convenience, HT(I,0) is set equal to the number of such headings on January 1, 1981. (Optional input. See Chapter 7, Section 3.)
K(I)	Average number of catalog cards required per title of class I for the old card catalog. If complete card sets are not filed for each title, then the average number of cards per title is less than the number for cards in a complete set.
KN(I)	Average number of catalog cards required per title of class I for the new or unified card catalog. For a split catalog KN(I) would normally equal K(I). However, if the new card catalog is used as a backup for a COM or on-line system, then KN(I) might be different from K(I). For example, if only a shelf list catalog is maintained as backup for the new catalog then KN(I) would equal 1.
LIB	Library name.
LPF	Lines of output per fiche if a fiche catalog is used (or lines of output per foot of film if a film catalog is produced) in the new or unified file.

LPFO	Lines of output per fiche if a fiche catalog is produced (or lines of output per foot of film if a film catalog is produced) in the old file.
LPFR(I)	Lines of output per full bibliographic record of class I titles in the COM catalog of the new or unified file.
LPFRO(I)	Lines of output per full bibliographic record of class I titles in the COM (or filmed) catalog of the old file.
LPSR(I)	Lines of output per short bibliographic record of class I titles in the COM catalog of the new or unified file.
LPSRO(I)	Lines of output per short bibliographic record of class I titles in the COM (or filmed) catalog of the old file.
NC(Y)	Number of copies of the COM catalog produced for each update and each supplement of the new or unified file in year Y.
NCDS(·,Y)	Total number of new catalog cards produced in year Y.
NCDS(I,Y)	Number of new cards for class I titles produced in year Y.
NCO(Y)	Number of copies of the microform catalog produced for each update and each supplement of the old file in year Y.
NCOMR(Y)	Number of microform readers in the library in year Y.
NCOMR(0)	Total number of microform readers in the library in year 0.
NCOMRI(Y)	Number of microform readers acquired and installed in year Y.
NCT	Number of different classes of titles.
NECPS	Number of entries checked to complete a search in the new or unified file.
NECPSO	Number of entries checked to complete a search in the old file.
NFRPT(I)	Number of full bibliographic records per title of class I in the COM catalog of the new or unified file. (The alternative selected determines whether the new or unified file is considered.)
NFRPTO(I)	Average number of full bibliographic records per title of class I in the COM (or filmed) catalog of the old file.

NHC(I,Y)	Number of substantial heading conflicts resolved and treated in year Y for titles of class I. (Optional input. See Chapter 7, Section 3.)
NHN(I,Y)	Number of unique headings associated with titles of class I newly cataloged during year Y. For convenience, NHN(I,1) applies to titles cataloged between January 1, 1981 and June 30, 1981. (Optional input. See Chapter 7, Section 3.)
NMFPT(I)	Number of master fiche (or feet of master film) per class I title in the COM catalog of the new or unified file.
NMFPTO(I)	Number of master fiche (or feet of master film) per class I title in the COM catalog of the old file.
NRT	Number of types of records used as the basis for the retrospective conversion.
NS	Number of cumulative supplements of the COM catalog of the new or unified file produced per year.
NSER(Y)	Number of searches in year Y by staff using new or unified catalog.
NSERO(Y)	Number of searches in year Y by staff using old catalog.
NSO(Y)	Number of cumulative supplements of the COM catalog of the old file produced in year Y.
NSRPT(I)	Number of short bibliographic records per title of class I in the COM catalog of the new (or unified) file.
NSRPTO(I)	Number of short bibliographic records per title of class I in the COM (or filmed) catalog of the old file.
NU	Number of updates per year of the entire COM catalog of the new or unified file.
NUO(Y)	Number of updates of the entire microform catalog of the old file in year Y.
OCAC(Y)	Cost of maintaining authority file in year Y. (Does not include cost of authority work done during cataloging.)
OCC(Y)	Cost of preparing catalog records in year Y.
OCHC(Y)	Cost in year Y of making headings changes for titles of all classes.
OCL(Y)	Cost in year Y of providing linkages, interfilings, etc., to resolve conflicts in headings resulting from AACR 2 for all titles.

OCRHC(Y)	Cost of resolving heading conflicts resulting from AACR 2 during year Y.
OFHC(Y)	Percentage of headings in the existing catalog that are in conflict with AACR 2 and not yet treated on June 30 of year Y.
OHT(Y)	Total number of headings in the library on June 30 of year Y, with Y = 1, 2, 3, 4, 5. Where appropriate, this is equal to the number of headings in the authority file (excluding topical subjects).
ONHC(Y)	Number of substantial heading conflicts resolved and treated in year Y.
OTNCF(Y)	Number of titles in the new card file on June 30 of year Y, with Y = 1, 2, 3, 4, 5.
OTNMRF(Y)	Number of titles in the new machine readable file on June 30 of year Y, with Y = 1, 2, 3, 4, 5.
OTT(Y)	Total number of titles in the library on June 30 of year Y, with Y = 1, 2, 3, 4, 5.
OTTS(Y)	Total number of titles in the old file on June 30 of year Y with Y = 1, 2, 3, 4, 5, assuming the old file is maintained.
PCTHC(I)	Percent of substantial heading conflicts in titles of class I resolved and treated by heading changes.
PCTL(I)	Percent of substantial heading conflicts in titles of class I resolved and treated by linkages, interfiling, etc.
PBCE	Period between catalog expansions for the new or unified file (in years).
PV	The discounted present value on January 1, 1980 of the cost component C(Y).
RC(I,J,Y)	The planned number of machine readable records of class I titles suitable for producing a COM or on-line catalog for the new file created from records of type J during year Y, and after January 1, 1981.
RCO(I,J)	Number of machine readable or microform records of class I titles created from records of type J between June 30, 1980 and January 1, 1981.
RID	Run identification number.
ROI	Rate of inflation (percent).
RPH(I)	Average number of records requiring change per heading change for titles of class I.

SQPC	Square feet of floor space per cabinet (including space for reference table and users).
TCDS(·,Y)	Average value during year Y of the total number of cards in the unified file. See equation 109.
TCDS(I,Y)	Average number of cards in the unified catalog for titles of class I during year Y.
TCE	Average time to check an entry in the new or unified file (seconds).
TCEO	Average time to check an entry in the old file (seconds).
TN(I,Y)	Number of titles of class I newly cataloged during year Y.
TNCF(I,Y)	Number of titles of class I in the new card file on June 30 of year Y.
TNCFS(I)	Number of titles of class I in the new card file on January 1, 1981.
TNMRF(I,Y)	Number of titles of class I in the new machine readable file on June 30 of year Y.
TNMRFS(I)	Number of titles of class I in the new machine readable file on January 1, 1981.
TPSO	Average number of titles appearing in each cumulative supplement of the old file.
TT(I,Y)	Total number of titles of class I in the unified file or in the old and new files combined on June 30 of year Y.
TT1(I)	Number of titles of class I in the unified file and in the old file on January 1, 1981.
TTAN(I,Y)	Total number of class I title appearances in the various versions of the COM catalog for the new file in year Y. The number of title appearances of a given title is the number of versions of the COM catalog in which that title appears. The various versions of the catalog include the updates of the entire file and the cumulative supplements.
TTAO(I,Y)	Total number of class I title appearances in the various versions of the COM (or filmed) catalog for the old file in year Y.
TTAU(I,Y)	Total number of class I title appearances in various versions of the COM catalog for the unified file in year Y.

TTO(I) Total number of titles of class I in the library and in the unified file on June 30, 1980.

TTS(I,Y) Total number of titles of class I in the old file on June 30 of year Y, assuming the old file is maintained. For convenience, TTS(I,0) is the number of such titles on January 1, 1981.

TW(I,Y) Number of titles of class I withdrawn from the library catalog in year Y.

UHPT(I,N) Average number of unique headings per title in a set of N titles of class I. When N is 1, UHPT(I,N) reduces to the average number of headings per title. As N increases, then UHPT(I,N) tends to decrease because of the overlap of headings among different titles.

CHAPTER 7

COST MODEL EQUATIONS

7.1 Growth of Titles and Headings

Many of the costs associated with developing and maintaining a library catalog depend on the number of titles in the library, and how fast this number is growing. Other costs depend on the number and growth rate of headings. Therefore, before developing expressions for the various cost elements, it is convenient to first consider how the numbers of titles and headings vary with time.

Titles may be grouped into classes, such as monographs, serials, and non-Roman alphabets. The bibliographic records of titles of a given class may be categorized further according to: a) the kind of file in which the record is stored; and, b) the form of the record. For this project, three kinds of files are considered:

- o unified
- o old
- o new

and two forms of records are considered:

- o cards
- o machine readable records suitable for producing a COM or on-line catalog.

When one of the unified catalog alternatives is considered, then all the records of a given class of title are assumed to be stored in a unified file in a specified form. When one of the split catalog alternatives is considered, then records of titles cataloged prior to January 1, 1981 are stored in the old file and those cataloged after January 1, 1981 are stored in the new file. The forms of the old and new files may be the same or different.

Expressions for the number of titles of a specified class in the unified, old and new files as a function of time (i.e. year) are described in the following sections.

7.1.1 Number of Titles in the Unified File

The number of titles in the unified file on June 30 of a specified year is denoted by the parameter TT (which also stands for total titles in the old and new files combined). Because this parameter depends on the class of titles considered (such as monographs and serials) and the year, its notation is extended to TT(I, Y) where I denotes the class of titles considered, and Y denotes the year: Y = 0 corresponds to 1980, Y = 1 corresponds to 1981, etc.

The particular value of TT(I, Y) for Y=0, i.e. for June 30, 1980, is denoted by TTO(I), an input parameter. Stated mathematically:

(1) $TT(I, 0) = TTO(I)$

Between June 30, 1980 and June 30, 1981 the number of newly cataloged titles added to the unified file is TN(I, 1), and the number of titles withdrawn from the unified file is TW(I, 1). Therefore, the number of titles of class I in the unified file on June 30, 1981, i.e. at the end of fiscal year 1 is:

(2) $TT(I, 1) = TT(I, 0) + TN(I, 1) - TW(I,1)$

More generally, we may say that:

(3) $TT(I, Y + 1) = TT(I, Y) + TN(I, Y + 1) - TW(I,Y + 1), \quad Y = 1, 2, 3, 4$

The average number of titles of class I in the unified file during fiscal year Y is:

(4) $ATT(I, Y) = 1/2 \left[TT(I, Y - 1) + TT(I, Y)\right], \quad Y = 1, 2, 3, 4, 5$

This equation for the average value is exact when the number of titles in the unified file varies linearly with time during the fiscal year.

The total number of titles of all classes on June 30 of year Y appears in the output and is given by:

(5) $$OTT(Y) = \sum_{I=1}^{NCT} TT(I, Y), \quad Y = 1, 2, 3, 4, 5$$

where $\sum_{I=1}^{NCT}$ denotes summation over all values of I.

7.1.2 Number of Titles in the Old File

The number of titles of class I in the old file of a split catalog on June 30 of fiscal year Y is denoted by TTS(I, Y), for Y = 1, 2, 3, 4, 5. On January 1, 1981 the old file contains all the titles of class I held by the library. This number of titles equals the number of titles on June 30, 1980, plus the number of newly cataloged titles added during 6 months minus the number titles withdrawn in 6 months and is:

(6) $TT1(I) = TTO(I) + 1/2\ TN(I,1) - 1/2\ TW(I, 1)$

After January 1, 1981, no newly cataloged titles are added to the old file; however, withdrawn titles are subtracted. Hence, the number of titles in the old file on June 30, 1981 is:

(7) $TTS(I, 1) = TTO(I) + 1/2\ TN(I, 1) - TW(I, 1)$

Thereafter, the number of titles in the old file decreases because of withdrawals; this is given by:

(8) $TTS(I, Y + 1) = TTS(I, Y) - TW(I, Y + 1), \quad Y = 1, 2, 3, 4$

The average number of titles of class I in the old file during year Y is given by:

(9) $ATTS(I, Y) = 1/2 \left[TTS(I, Y-1) + TTS(I, Y)\right], \quad Y = 1, 2, 3, 4, 5$

Equation (9) is strictly valid only if TTS varies linearly during each fiscal year. During the year Y = 1, TTS increases during the first six months from TTO to TTO + 1/2 TN - 1/2 TW, and decreases during the last six months from TTO + 1/2 TN - 1/2 TW to TTO + 1/2 TN - TW. Equation (9) can be made to produce the correct average value by defining TTS (I, 0) as follows:

(10) $TTS(I, 0) = TTO(I) + 1/4\ TN(I, 1)$

This produces an average value of TTO + 3/8 TN - 1/2 TW for year Y = 1.

The total number of titles in the old file for all classes on June 30 of year Y appears in the output and is given by:

(11) $$OTTS(Y) = \sum_{I=1}^{NCT} TTS(I, Y), \quad Y = 1, 2, 3, 4, 5$$

7.1.3 Number of Titles in the New File

The bibliographic records stored in the new file of a split catalog may be in two forms: card form and machine readable form.

7.1.3.1 Card form

The number of titles of class I in the new card file on June 30 of year Y is denoted by TNCF(I, Y), Y = 1, 2, 3, 4, 5. On January 1, 1981, the new card file contains TNCFS(I) titles, by definition. (See Chapter 6.) Between January 1 and June 30, 1981, 1/2 TN(I, 1) newly cataloged titles are added to it. Therefore on June 30, 1981, the number of titles in the new file is:

(12) $TNCF(I, 1) = TNCFS(I) + 1/2\ TN(I, 1)$

Each year thereafter the new card file grows by the number of newly cataloged titles added to it:

(13) $TNCF(I, Y+1) = TNCF(I, Y) + TN(I, Y+1), \quad Y = 1, 2, 3, 4$

The average number of titles in the new card file during year Y is given by:

(14) $ATNCF(I, 1) = 1/2 \left[TNCFS(I) + TNCF(I,1)\right]$, for Y = 1, and

(15) $ATNCF(I, Y) = 1/2 \left[TNCF(I, Y-1) + TNCF(I, Y)\right], \quad Y = 2, 3, 4, 5$

where we define:

(16) TNCF(I, 0) = TNCFS(I)

From equations (12) and (14) it follows that ATNCF(I, 1) is the average number of titles in the new card file over the six month period, January 1 to June 30, 1981.

The total number of titles in the new card file during fiscal year Y for all classes of titles appears in the output and is given by:

$$(17)\quad OTNCF(Y) = \sum_{I=1}^{NCT} TNCF(I, Y),\quad Y = 1, 2, 3, 4, 5$$

7.1.3.2 Machine Readable Form

The number of titles of class I in the new machine readable file on June 30 of year Y is denoted by TNMRF(I, Y). On January 1, 1981 the new machine readable file contains TNMRFS(I) titles, by definition. (See Chapter 6.) Between January 1 and June 30, 1981 the number of titles in this file may increase for two reasons: a) newly cataloged titles are added; b) retrospectively converted titles are added. This is expressed in the following equation:

(18) TNMRF(I, 1) = TNMRFS(I) + 1/2 TN(I, 1) + RC(I,·, 1)

where RC(I,·, 1) is the number of titles of class I retrospectively converted into machine readable form between January 1 and June 30, 1981. (The dot in place of the second index of RC indicates summation over all values of that index.)

In subsequent years, we have:

(19) TNMRF(I, Y+1) = TNMRF(I, Y) + TN(I, Y+1) + RC(I, ·, Y+1), Y = 1, 2, 3, 4

where RC(I, ·, Y) is the number of titles of class I retrospectively converted during fiscal year Y.

The average number of titles in the new machine readable file during fiscal year Y is given by:

(20) ATNMRF(I,1) = 1/2[TNMRFS(I) + TNMRF(I, 1)], for Y = 1, and

(21) ATNMRF(I, Y) = 1/2 [TNMRF(I,Y-1) + TNMRF(I, Y)], Y = 2, 3, 4, 5

The total number of titles in the new machine readable file on June 30 of year Y, summed over all classes of titles appears in the output and is given by:

$$(22)\quad OTNMRF(Y) = \sum_{I=1}^{NCT} TNCF(I, Y),\quad Y = 1, 2, 3, 4, 5$$

7.1.4 Number of Unique Headings per Title

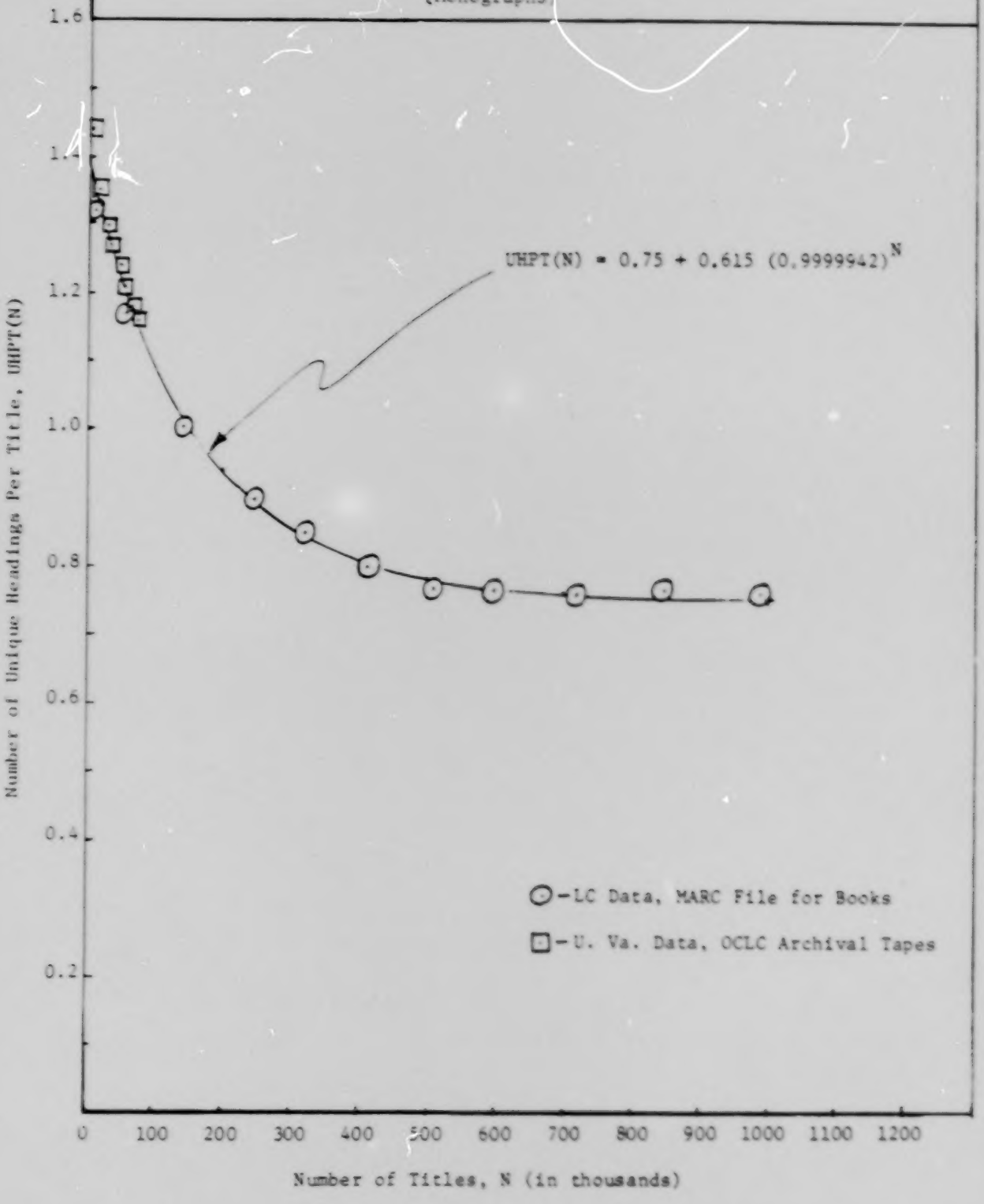
Since our primary purpose in considering headings is to determine the impact of AACR 2 on library catalog costs, our attention will be focused only on those headings affected by AACR 2, that is personal name, corporate name, uniform title, and series headings. Topical subject headings, for example, are excluded in our definition of headings.

The number of unique headings per title in a collection of N titles depends on the magnitude of N. One possible way of explaining this dependence is by considering the headings for a given title to be of two types: 1) common headings, i.e. those likely to overlap with headings assigned to other titles; 2) uncommon headings, i.e. those not likely to overlap with headings assigned to other titles. (An example of a heading of the second type is an author who publishes a single title during his lifetime and who is not the subject of the writings of others.) The number of unique headings consists of contributions from common headings plus uncommon headings. For small values of N there is relatively little overlap in headings, so that there are many common headings unique to the file as well as uncommon ones. As N increases, the number of unique uncommon headings increases proportionally with N. However the number of common headings unique in the file increases less than proportionally with N due to overlap. For extremely large values of N, the contribution of common headings to unique headings becomes negligible, leaving only the contribution of uncommon headings. The corresponding behavior of the number of unique headings per title follows this pattern. For small values of N, the number of unique headings per title is the sum of the contributions of both common and uncommon headings per title. As N increases, common headings contribute fewer unique headings and the number of unique headings per title falls, ultimately reaching a number approximately equal to the number of uncommon headings per title.

Figure 7.1 shows the behavior of the number of unique headings per title as a function of the number of titles included in the collection based on data from two sources, the Library of Congress and the University of Virginia Library. The LC data were derived from the MARC file for books by Sally H. McCallum of LC's Network Development Office. The values of N plotted on Figure 7.1 for LC equal the number of titles in the MARC file for books at the end of the years 1968 through 1978. The corresponding values of the number of unique headings per title were obtained by dividing the number of unique headings by the number of titles. Included in these headings are personal names, corporate names, conference names, and uniform titles, when appearing as either added entries or as subjects in MARC records. The complete corporate headings were compared, including entry elements and all lower level units in the corporate hierarchy. Subject subdivisions appearing in name headings were dropped before determination of uniqueness. The University of Virginia Library data were derived from OCLC archival tapes by David T. Buxton, Automation Librarian. These tapes contained bibliographic records for 70,000 titles and therefore are limited to values of N of 70,000 and less.

FIGURE 7.1
NUMBER OF UNIQUE HEADINGS PER TITLE
IN A COLLECTION OF N TITLES

(Monographs)



The solid line in Figure 7.1 approximates the data from both LC and University of Virginia. This line can be described mathematically by the following equation*: $UHPT(I,N) = 0.75 + 0.615 \cdot (0.9999942)^N$. More generally we may write:

$$(23) \quad UHPT(I,N) = A(I) + B(I) \cdot Q(I)^N$$

where, in view of the above discussion concerning common and uncommon headings, A(I), B(I) and Q(I) may be given the following interpretations:

A(I) = the expected number of uncommon headings per title of class I

B(I) = the expected number of common headings per title of class I

Q(I) = the probability that when a new title is added to a collection of class I titles, its common headings have not yet occurred in the previous set of headings.

Table 7.1 presents the values of A(I), B(I) and Q(I) used in the Library Catalog Cost Model for various classes of titles. For monographs (I=1) the values correspond to Figure 7.1, increased by six percent. This six percent adjustment reflects the fact that series headings (which account for approximately six percent of the headings) were excluded from the LC data used to construct Figure 7.1. For serials (I=2) values of A(2) and B(2) were set equal to 0.7 times A(1) and B(1), respectively. These adjustments reflect the fact that, on the average, serial titles have approximately 70 percent as many headings per title as do monograph titles. For other classes of titles, it was assumed that the monograph values applied. Additional research is required to improve the accuracy of the parameters in Table 7.1, particularly for the non-monographs.

Table 7.1

VALUES OF PARAMETERS IN EQUATION 23

I	Class of Titles	A(I)	B(I)	Q(I)
1.	Monographs	0.795	0.652	0.9999942
2.	Serials	0.5565	0.4564	0.9999942
3.	Other	0.795	0.652	0.9999942
4.	One class	0.795	0.652	0.9999942

*This equation is based on the observation that log (UHPT(1,N) - 0.75) when plotted against N fits a straight line. The slope and intercept of this straight line were estimated to be log0.9999942 and log0.615, respectively. Semilog paper is particularly convenient for making those estimates.

The development of Equation 23 was a key step in the construction of the cost model. The reason for this is that all the participating libraries were able to furnish data concerning the numbers of titles of a given class, but few were able to furnish adequate data concerning the number of headings. Equation 23 permits one to estimate the number of unique headings from the associated number of titles. In those few instances where individual libraries had adequate information on headings library values were used instead of Equation 23.

7.1.5 Number of New Headings and Total Headings in the Library

The total number of headings in the library on January 1, 1981 HT(I,0) depends on the number of titles in the library on January 1, 1981, TT1(I), and may be estimated by multiplying the number of titles by the corresponding value of the number of unique headings per title:

(24) $HT(I, 0) = TT1(I) \cdot UHPT(I, TT1(I))$

By similar reasoning, the total number of headings on June 30 of year Y is given by:

(25) $HT(I,Y) = TT(I, Y) \cdot UHPT(I, TT(I,Y)), \quad Y = 1, 2, 3, 4, 5$

The number of new headings added to the library during fiscal year Y and after January 1, 1981 is the difference between the number of headings at the end of year Y and the end of year Y-1:

(26) $HN(I, Y) = HT(I, Y) - HT(I, Y - 1), \quad Y = 1, 2, 3, 4, 5$

The total number of headings of titles of all classes appears in the output and is given by:

$$(27) \quad OHT(Y) = \sum_{I=1}^{NCT} HT(I, Y), \quad Y = 1, 2, 3, 4, 5$$

7.1.6 Number of Headings Associated with Newly Cataloged Titles

The number of headings associated with titles newly cataloged between January 1, 1981 and June 30, 1981, NHN (I, 1), depends on the number of titles newly cataloged during that period, TN1 (I). Following the same reasoning used to arrive at Equation 24, it may be estimated by

(28) $NHN(I, 1) = TN1(I) \cdot UHPT(I, TN1(I))$

where:

(29) $TN1(I) = 1/2\ TN(I, 1)$

Similarly the number of headings associated with titles newly cataloged during year Y is:

(30) $NHN(I, Y) = TN(I, Y) \cdot UHPT(I, TN(I,Y)), \quad Y = 2, 3, 4, 5$

7.2 Cataloging, Editing, and Authority Control Costs

The cost of cataloging newly cataloged titles of class I during year Y is the average cost of cataloging a title times the number of titles, and is given by:

$$(31)\quad CC(I, Y) = CCPT(I) \cdot TN(I, Y)$$

where:

CC(I,Y) = the cost of preparing catalog records for titles of class I in year Y,

CCPT(I) = the average cost of cataloging a title of class I, and

TN(I,Y) = the number of titles of class I newly cataloged during fiscal year Y.

By summing the cost over all classes of titles we obtain the total annual cost of cataloging:

$$(32)\quad OCC(Y) = \sum_{I=1}^{NCT} CC(I,Y),\ Y = 1, 2, 3, 4,5$$

The cost of editing the old file in fiscal year Y, CEOF (Y), is the average annual cost of editing the old file per title of class I in the old file times the number of titles of class I, summed over all classes of titles:

$$(33)\quad CEOF(Y) = \sum_{I=1}^{NCT} CEOPT(I, Y) \cdot ATTS(I, Y),\ Y = 1, 2, 3, 4, 5$$

where:

CEOPT(I,Y) = the annual cost of editing the old file per title of class I in the old file, and

ATTS(I,Y) = the average number of titles of class I in the old file during fiscal year Y.

The cost of authority control in fiscal year Y is the average annual cost of maintaining an authority file per title of class I times the average number of titles of class I in the library in year Y, summed over all classes of titles:

$$(34)\quad CAC(I, Y) = CACPT(I) \cdot ATT(I, Y)$$

$$(35)\quad OCAC(Y) = \sum_{I=1}^{NCT} CAC(I, Y)$$

where:

CAC(I,Y) = the cost of maintaining an authority file in fiscal year Y for titles of class I,

CACPT(I) = the average cost of maintaining an authority file per title of class I,

ATT(I,Y) = the average number of titles of class I in the library in year Y.

The costs of editing the new files are based on similar reasoning, with one minor difference: during the first fiscal year, the new file is in existence only 6 months, from January 1 to June 30, 1981. Therefore, for the first fiscal year the costs are only half the annual figure. These considerations lead to the following set of equations:

$$(36)\quad CENCF(1) = 1/2 \sum_{I=1}^{NCT} CECPT(I) \cdot ATNCF(I, 1)$$

$$(37)\quad CENCF(Y) = \sum_{I=1}^{NCT} CECPT(I) \cdot ATNCF(I, Y),\ Y = 2, 3, 4, 5$$

$$(38)\quad CENMRF(1) = 1/2 \sum_{I=1}^{NCT} CEMRPT(I) \cdot ATNMRF(I, 1)$$

$$(39)\quad CENMRF(Y) = \sum_{I=1}^{NCT} CEMRPT(I) \cdot ATNMRF(I, Y),\ Y = 2, 3, 4, 5$$

where:

CENCF(Y) = the cost of editing the new card file in fiscal year Y.

CENMRF(Y) = the cost of editing the new machine readable file in fiscal year Y,

CECPT(I) = the annual cost of editing the new or unified card file per title of class I in the file,

CEMRPT(I) = the annual cost of editing the new or unified machine readable file per title of class I in the file

ATNCF(I,Y) = the average number of titles in the new card file during the period January 1 to June 30 for Y = 1, and during fiscal year Y for Y = 2, 3, 4, 5,

ATNMRF(I,Y) = the average number of titles in the new machine readable file during the period January 1 to June 30, 1981 for Y = 1, and during fiscal year Y for Y = 2, 3, 4, 5.

The costs of editing unified files are based on similar reasoning and are given by these equations:

$$(40)\quad CEUCF(Y) = \sum_{I=1}^{NCT} CECPT(I) \cdot ATT(I, Y),\ Y = 1, 2, 3, 4, 5$$

$$(41)\quad CEUMRF(Y) = \sum_{I=1}^{NCT} CEMRPT(I) \cdot ATT(I, Y),\ Y = 1, 2, 3, 4, 5$$

where:

CEUCF(Y) = the cost of editing the unified card file in fiscal year Y,

CEUMRF(Y) = the cost of editing the unified machine readable file in fiscal year Y,

ATT(I,Y) = the average number of titles in the library and in the unified file during fiscal year Y.

7.3 Additional AACR 2 Costs

The cost in fiscal year Y of resolving heading conflicts resulting from AACR 2 for titles of class I, CRHC (I,Y), is the average cost of intellectual work required to resolve a substantial heading conflict resulting from AACR 2 for a title of class I, CRCPC(I), times the number of heading conflicts resolved in year Y, NHC(I,Y).

$$(42)\quad CRHC(I, Y) = CRCPC(I) \cdot NHC(I, Y)$$

The corresponding cost for all classes of titles is:

$$(43)\quad OCRHC(Y) = \sum_{I=1}^{NCT} CRHC(I, Y)$$

The cost in fiscal year Y of making heading changes to accommodate AACR 2 for titles of class I, CHC(I,Y), is the product of four quantities: 1) the average cost of making a heading change on an existing bibliographic record of a class I title, CHCPR(I); 2) the average number of records of class I titles requiring change for each heading change, RPH(I); 3) the number of headings of class I titles treated in year Y, NHC(I,Y); and, 4) the proportion of heading conflicts of class I titles treated by heading changes, PCTHC(I)/100:

$$(44)\quad CHC(I, Y) = CHCPR(I) \cdot RPH(I) \cdot NHC(I, Y) \cdot \frac{PCTHC(I)}{100}$$

This cost summed over all classes of titles is:

$$(45)\quad OCHC(Y) = \sum_{I=1}^{NCT} CHC(I, Y)$$

The cost in fiscal year Y of producing linkages, interfilings, etc. per heading conflict of a class I title treated is the product of three terms: 1) the average cost of creating linkages (or of interfiling, etc.) per heading conflict treated, CLPH(I); 2) the number of heading conflicts treated, NHC(I,Y); and, 3) the proportion of heading conflicts treated by means of linkages or interfilings, etc., PCTL(I)/100:

$$(46)\quad CL(I, Y) = CLPH(I) \cdot NHC(I, Y) \cdot \frac{PCTL(I)}{100}$$

This cost summed over all classes of titles is:

$$(47)\quad OCL(Y) = \sum_{I=1}^{NCT} CL(I, Y)$$

Equations 42, 44 and 46 require values for NHC(I, Y), the number of heading conflicts resolved and treated in year Y for titles of class I. These values are obtained by one of two options: 1) by means of equations (described below) based on the assumption that we resolve and treat only those conflicts created by titles newly cataloged in year Y; 2) by means of values supplied by the user. The equations used for carrying out the first option are described below.

Figure 7.2(a) depicts two sets of headings for titles of class I on January 1, 1981:

1. the set of headings in the existing catalog, E;

2. the set of headings in the universe that are in conflict with AACR 2, C.

The number of headings in E, by definition, is equal to HT(I,0). The percent of these in conflict with AACR 2, by definition, equals FHCS(I); and the proportion of these in conflict on January 1, 1981 is:

$$(48)\quad FHC(I,0) = FHCS(I) \div 100$$

Figure 7.2(b) includes one more set of headings: N, the set of headings associated with titles newly cataloged between January 1 and June 30, 1981. By definition the number of headings in N is NHN(I,1). The heading conflicts that are resolved and treated between January 1, 1981 and June 30, 1981, are represented by the cross-hatch region of Figure 7.2(b). These headings must be: 1) associated with the newly cataloged titles, 2) in conflict with AACR 2 and, 3) in the existing file; they must be in the intersection of the sets N, C and E.

Under the assumption that the proportion of headings in conflict with AACR 2 is the same for both E and N, we can estimate NHC (I, 1) as follows:

$$(49)\quad NHC(I,1) = \left[NHN(I,1) - HN(I,1)\right] \cdot FHC(I,0)$$

Equation 49 states that the number of headings in N, C and E (viz. NHC(I, 1)) is equal to the number of headings in N and E (viz. NHN(I, 1) - $\overline{HN(I,1)}$) times the proportion of these headings that are in C (viz. $\overline{FHC}(I,0)$).

Figure 7.2(c) shows the state of the sets E and C on June 30, 1981; they have been converted to the sets E' and C': E has increased to E' and C has decreased to C'.

The number of heading conflicts in the catalog is FHC (I,0) · HT (I,0) on January 1, 1981 and FHC(I, 1) · HT(I, 1) on June 30, 1981. Since NHC (I, 1) is the difference between these two numbers we have:

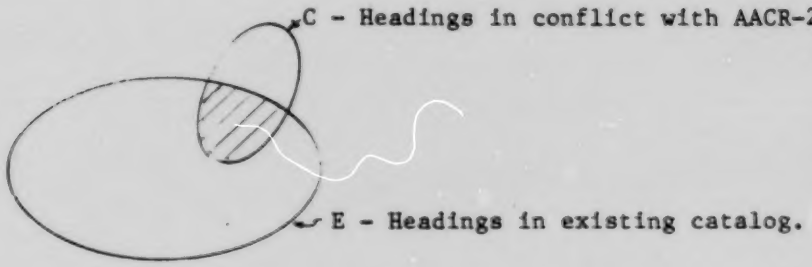
$$NHC(I,1) = \left[FHC(I,0) \cdot HT(I,0)\right] - \left[FHC(I,1) \cdot HT(I,1)\right]$$

Solving this equation for FHC(I,1) and substituting Equations 49 and 26 into the result yields:

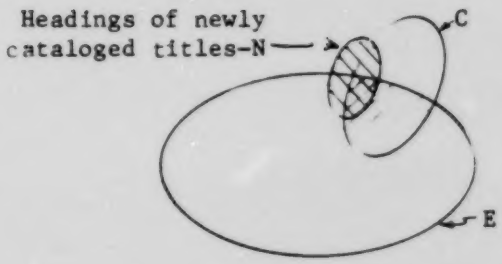
$$(50)\quad FHC(I,1) = FHC(I,0) \cdot \left[1 - \frac{NHN(I,1)}{HT(I,1)}\right]$$

The above argument can be generalized by letting Figure 7.2(a) correspond to the beginning of fiscal year Y+1 (and the end of fiscal year Y), N correspond to the number of titles newly cataloged during fiscal year Y+1, and Figure 7.3(c) correspond to the end of fiscal year Y+1. Then the generalized versions of Equations 49 and 50 become:

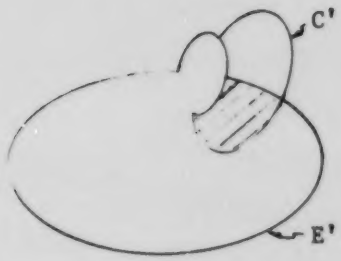
FIGURE 7.2
REDUCTION IN THE NUMBER OF HEADING CONFLICTS WITH TIME



(a) Sets of Headings E and C on January 1, 1981



(b) Inclusion of Set N



(c) Sets of Heading E' and C' on June 30, 1981

$$(51)\quad NHC(I, Y+1) = NHN(I, Y+1) - HN(I, Y+1) \cdot FHC(I, Y),\quad Y = 0, 1, 2, 3, 4$$

and

$$(52)\quad FHC(I, Y+1) = FHC(I, Y) \cdot \left[1 - \frac{NHN(I, Y+1)}{HT(I, Y+1)}\right],\quad Y = 0, 1, 2, 3, 4$$

The number of heading conflicts resolved and treated in fiscal year Y summed over all classes of titles is:

$$(53)\quad ONHC(Y) = \sum_{I=1}^{NCT} NHC(I, Y)$$

The proportion of headings in the library in conflict with AACR 2 in fiscal year Y, averaged over all classes of title is:

$$(54)\quad OFHC(Y) = \left(\sum_{I=1}^{NCT} FHC(I,Y) \cdot HT(I,Y)\right) \div OHT(Y)$$

where:

$$(55)\quad OHT(Y) = \sum_{I=1}^{NCT} HT(I,Y)$$

7.4 Cost of Card Catalogs

Card catalog costs include the following components:

1. producing cards
2. sorting and filing these cards
3. maintaining the card files
4. space used to house the cards
5. acquiring additional cabinets
6. catalog expansion.

The costs of card catalogs depend on the number of cards for the following sets of titles:

- o the newly cataloged titles
- o the total titles (in the unified file)
- o the titles in the old card file
- o the titles in the new card file

It is convenient to obtain expressions for the number of cards for each set of titles before determining relationships for the six cost components.

7.4.1 Number of Cards

The number of cards needed for class I titles newly cataloged in fiscal year Y is given by:

$$(56)\quad NCDS(I, Y) = TN(I, Y) \cdot KN(I)$$

where KN(I) is the average number of cards required per title of class I for the new or unified card file. The total number of cards needed for titles newly cataloged in year Y, NCDS(·, Y), is obtained by summing this number of cards over all classes of titles:

$$(57)\quad NCDS(\cdot, Y) = \sum_{I=1}^{NCT} TN(I, Y) \cdot KN(I)$$

(Recall that definitions of terms appearing in the equations are given in Chapter 6.)

The average number of cards for the titles of class I in the unified file during fiscal year Y, TCDS(I,Y), is given by:

$$(58)\quad TCDS(I, Y) = ATT(I, Y) \cdot KN(I)$$

Summing this number of cards over all the classes of titles gives the average total number of cards in the unified file during fiscal year Y, TCDS(·, Y):

$$(59)\quad TCDS(\cdot, Y) = \sum_{I=1}^{NCT} TCDS(I, Y)$$

The average number of cards for the titles of class I in the old card file during fiscal year Y, CDSOF(I,Y) is given by:

$$(60)\quad CDSOF(I, Y) = ATTS(I, Y) \cdot K(I)$$

where K(I) is the average number of cards required per title in the old file. Summing this number of cards over all the classes of titles gives the average number of cards in the old file during fiscal year Y, CDSOF(·, Y):

$$(61)\quad CDSOF(\cdot, Y) = \sum_{I=1}^{NCT} CDSOF(I, Y)$$

The average number of cards for titles of class I in the new card file during fiscal year Y, CDSNF(I,Y), is:

$$(62)\quad CDSNF(I, Y) = ATNCF(I, Y) \cdot KN(I)$$

where KN (I) is the average number of cards required per title of class I for the new card catalog. Summing this number of cards over all the classes of titles gives the average number of cards in the new file during fiscal year Y, CDSNF(·, Y):

$$(63)\quad CDSNF(\cdot, Y) = \sum_{I=1}^{NCT} CDSNF(I, Y)$$

7.4.2 Card Production

The cost of producing cards for newly cataloged titles in year Y, CPC(Y), is given by:

$$(64)\quad CPC(Y) = \sum_{I=1}^{NCT} NCDS(I, Y) \cdot \left[CCL(I) \cdot \frac{FL}{100} + \left(1 - \frac{FL}{100}\right) \cdot CN \right]$$

where CCL (I) is the cost of producing a card locally for class I titles, CN is the cost of producing a card by a network, and FL is the percent of cards produced locally.

7.4.3 Sorting and Filing

The cost of sorting and filing the cards for the newly cataloged titles in year Y is:

$$(65)\quad CSF(Y) = NCDS(\cdot, Y) \cdot CFSPC$$

where CFSPC is the cost of sorting and filing per card.

7.4.4 Card File Maintenance

The cost of maintaining the unified file in fiscal year Y is:

$$(66)\quad CM(Y) = \sum_{I=1}^{NCT} TCDS(I, Y) \cdot CMPC(I) \cdot \frac{FM(I)}{100}$$

where CMPC(I) is the average cost of pulling, changing, refiling, and revising per card treated for class I titles, and FM(I) is the percent of cards for class I titles requiring pulling, changing, etc., excluding the impact of AACR 2.

The cost of maintaining the old card file in fiscal year Y is:

$$(67)\quad CMO(Y) = \sum_{I=1}^{NCT} CDSOF(I, Y) \cdot CMPC(I) \cdot \frac{FM(I)}{100}$$

The cost of maintaining the new card file in fiscal year Y is:

$$(68)\quad CMN(Y) = \sum_{I=1}^{NCT} CDSNF(I,Y) \cdot CMPC(I) \cdot \frac{FM(I)}{100}$$

7.4.5 Space for Housing Cards

The cost of housing the cards in the unified file in fiscal year Y is the product of three terms: 1) the number of cabinets used to house the cards, 2) the square feet of floor space per cabinet, SQPC, 3) the cost per square foot of floor space, CSQ.

$$(69)\quad CH(Y) = \left[\frac{TCDS(\cdot, Y)}{CPCB}\right] \cdot SQPC \cdot CSQ$$

where CPCB is the average number of cards per cabinet. The quotient within the brackets is the number of cabinets (i.e. cards divided by cards per cabinet).

The costs of housing the cards in the old card file and new card file in year Y are computed similarly, except that the number of cards and the corresponding numbers of cabinets are different. The equations for the cost of housing the old and new card files in fiscal year Y are:

$$(70)\quad CHOF(Y) = \left[\frac{CDSOF(\cdot, Y)}{CPCB}\right] \cdot SQPC \cdot CSQ$$

$$(71)\quad CHNF(Y) = \left[\frac{CDSNF(\cdot, Y)}{CPCB}\right] \cdot SQPC \cdot CSQ$$

7.4.6 Acquisition of Card Cabinents

The cost of acquiring new cabinets is smoothed out over time by assuming that enough cabinets are acquired each year to accommodate the new cards for the newly cataloged titles. (In reality, cabinets might be acquired every 2 to 5 years, with cramped space just before the acquisition and slack space just after the acquisition.)

Under this smoothing assumption the cost of acquiring new cabinets in fiscal year Y is the product of the number of cabinets required to house the new cards times the cost of acquiring and installing a card cabinet, CCAB.

$$(72)\quad CNC(Y) = \left[\frac{NCDS(\cdot, Y)}{CPCB}\right] \cdot CCAB$$

7.4.7 Card Catalog Expansion

The labor cost of catalog expansion is also smoothed out over time. Under this assumption the labor cost of catalog expansion in fiscal year Y is the product of two terms: 1) the number of cabinets needed to hold the cards in fiscal year Y, assuming that CPCB cards are stored in each cabinet; and, 2) the average labor cost of catalog expansion per cabinet per year. The first term is the total number of cards in the library divided by CPCB. The second term is the labor cost of catalog expansion per cabinet, CEPC, divided by the period (in years) between catalog expansion, PBCE. Therefore, the labor cost of catalog expansion is fiscal year Y for a unified card file, CCE(Y), is given by:

$$(73)\quad CCE(Y) = \left[\frac{TCDS(\cdot, Y)}{CPCB}\right] \cdot \left[\frac{CEPC}{PBCE}\right]$$

and for a new card file, CCEN(Y), is given by:

$$(74)\quad CCEN(Y) = \left[\frac{CDSNF(\cdot, Y)}{CPCB}\right] \cdot \left[\frac{CEPC}{PBCE}\right]$$

We assume that the old card file, which is either closed or frozen, undergoes no expansion. The possibility of reducing the number of cabinets by packing cards more tightly, selling the cabinets and recovering floor space can be accommodated by means of the cost adjustments, CED(Y) and CSP(Y), discussed in section 7.10.

7.5 Cost of Retrospective Conversion

During the 1981 fiscal year, the number of suitable machine readable records created consist of those created between June 30 and December 31, 1980 viz RCO, and those created between January 1 and June 30, 1981, viz RC. During the following fiscal years, the number of machine readable records created is RC. Since the cost of retrospective conversion equals the cost of conversion per record times the number of records converted, the following equations apply:

$$(75)\quad CRC(I, J, 1) = CCPR(I, J) \cdot RC(I, J, 1) + RCO(I, J)$$

$$(76)\quad CRC(I, J, Y) = CCPR(I, J) \cdot RC(I, J, Y),\ Y = 2, 3, 4, 5$$

$$(77)\quad CRECON(Y) = \sum_{I=1}^{NCT} \sum_{J=1}^{NTR} CRC(I, J, Y)$$

where:

CRC(I,J,Y) = the cost during fiscal year Y of creating machine readable (or microform) records suitable for producing a COM, filmed, or online catalog for titles of class I from records of type J.

CCPR(I,J) = the cost of creating a machine readable (or microform) record suitable for producing a COM, filmed, or online catalog for a title of class I from a record of type J.

CRECON(Y) = the cost during fiscal year Y of creating machine readable (or microform) records suitable for producing a COM, filmed, or online catalog

NRT = the number of types of records used as the basis for retrospective conversion.

7.6 Costs of COM or Filmed Catalogs

7.6.1 Cost of Entering and Storing Records

The cost in fiscal year Y of keying in records for newly cataloged titles of class I and creating machine readable records suitable for producing a COM catalog, CER(Y), is the cost per title times the number of titles, summed over all classes of titles:

$$(78)\quad CER(Y) = \sum_{I=1}^{NCT} CERPT(I) \cdot TN(I, Y)$$

where:

CERPT(I) = the average cost per newly cataloged title of class I of entering and creating machine readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records.

The cost in the fiscal year Y of storing the machine readable records suitable for producing a COM catalog for the unified file is the average cost per title times the number of titles in the unified file, summed over all classes of titles:

$$(79)\quad CSR(Y) = \sum_{I=1}^{NCT} CSRPT(I) \cdot ATT(I, Y)$$

where:

CSRPT(I) = the average cost per title of class I of storing machine readable records.

The cost in fiscal year Y of storing machine readable reords suitable for producing a COM catalog of the old file is:

$$(80)\quad CSRO(Y) = \sum_{I=1}^{NCT} CSRPT(I) \cdot ATTS(I, Y)$$

The cost in fiscal year Y of storing machine readable records suitable for producing a COM catalog of the new file is:

$$(81)\quad CSRN(Y) = \sum_{I=1}^{NCT} CSRPT(I) \cdot ATNMRF(I, Y)$$

The cost in fiscal year Y of maintaining the machine readable records suitable for producing a COM catalog is the average cost per title times the number of titles, summed over all classes of titles. For the unified file this cost is:

$$(82)\quad CMR(Y) = \sum_{I=1}^{NCT} CMRPT(I) \cdot ATT(I, Y)$$

where:

CMRPT(I) = the average cost per title of class I of maintaining machine readable records.

For the old file this cost is:

$$(83)\quad CMRO(Y) = \sum_{I=1}^{NCT} CMRPT(I) \cdot ATTS(I, Y)$$

For the new file this cost is:

$$(84)\quad CMRN(Y) = \sum_{I=1}^{NCT} CMRPT(I) \cdot ATNMRF(I, Y)$$

(Note: Table 2.2 and Chapter 6 define all the parameters appearing in the equations.)

7.6.2 COM Catalog Production Costs

The cost of producing COM catalogs in fiscal year Y equals the product of two terms: 1) the cost per class I title appearance* in year Y, 2) the number of class I title appearances in year Y, summed over all classes of titles. Expressions will now be derived for these two quantities.

*Each time a title appears in one of the versions (updates or supplements) of the COM catalog, we have a title appearance.

7.6.2.1 Cost per Class I Title Appearance

The components of cost per title appearance include: computer processing cost, master fiche production cost, and copy fiche production cost. The computer processing cost per title of class I equals the cost per access point times the number of access points (or records in the COM catalog) per title. For the old file the processing cost per title of class I, CPPTO(I), is given by:

$$(85)\quad CPPTO(I) = CPRO(I) \cdot \left[NFRPTO(I) + NSRPTO(I)\right]$$

where:

CPRO(I) = the cost for processing a record of a class I title to produce a COM (or other microform) catalog of the old file.

NFRPTO(I) = the average number of full bibliographic records per class I title in the COM (or other microform) catalog of the old file.

NSRPTO(I) = the average number of short bibliographic records per class I title in the COM (or other microform) catalog of the old file.

The quantity in square brackets is the number of access points per title.

For the new or unified file the computer processing cost per title of class I, CPPT(I), is given by:

$$(86)\quad CPPT(I) = CPR(I) \cdot \left[NFRPT(I) + NSRPT(I)\right]$$

where:

CPR(I) = the cost for processing a record of a class I title to produce a COM catalog of the new or unified file.

NFRPT(I) = the average number of full bibliographic records per class I title in the COM catalog of the new or unified file.

NSRPT(I) = the average number of short bibliographic records per class I title in the COM catalog of the new or unifed file.

The master fiche production cost per title equals the cost per master fiche times the number of fiche per title. For the old file the master fiche production cost per class I title is:

$$(87)\quad CMFPTO(I) = CPMFO \cdot NMFPTO(I)$$

and for the new or unified file this cost is:

$$(88)\quad CMFPT(I) = CPMF \cdot NMFPT(I)$$

where:

CMFPTO(I) = the cost of producing master fiche (or master film) per title of class I in the COM (or other microform) catalog of the old file.

CMFPT(I) = the cost of producing master fiche (or master film) per class I title in the COM catalog of the new or unified file.

NMFPTO(I) = the number of master fiche (or feet of master film) per class I title in the COM (or other microform) catalog of the old file.

NMFPT(I) = the number of master fiche (or feet of master film) per class I title in the COM catalog of the new or unified file.

CPMFU = the cost per master fiche (or foot of master film) for the catalog of the old file.

CPMF = the cost per master fiche (or foot of master film) for the catalog of the new or unified file.

The number of master fiche per title equals the number of lines of output per title divided by the number of lines of output per fiche. For the old file the number of master fiche per title is:

$$(89)\quad NMFPTO(I) = \frac{NFRPTO(I)\ .\ LPFRO(I) + NSRPTO(I)\ .\ LPSRO(I)}{LPFO}$$

where:

LPFRO(I) = the lines of output per full bibliographic record of a class I title in the COM or microform catalog of the old file.

LPSRO(I) = the lines of output per short bibliographic record of a class I title in the COM catalog of the old file.

LPFO = the lines of output per fiche (or foot of film) in the COM catalog of the old file.

For the new or unified file the number of master fiche per class I title is:

$$(90)\quad NMFPT(I) = \frac{NFRPT(I)\ .\ LPFR(I) + NSRPT(I)\ .\ LPSR(I)}{LPF}$$

where:

LPFR(I) = the lines of output per full bibliographic record of a class I title in the COM catalog of the new or unified file.

LPSR(I) = the lines of output per short bibliographic record of a class I title in the COM catalog of the new or unified file.

LPF = the lines of output per fiche (or foot of film) in the COM catalog of the new of unified file.

The copy fiche production cost per title for one copy of the catalog is the cost per copy fiche times the number of fiche per title. For the old file this cost is:

(91) CCFPTO(I) = CPCFO · NMFPTO(I)

and for the new or unified file this cost is:

(92) CCFPT(I) = CPCF · NMFPT(I)

where:

CCFPTO(I) = the cost of producing copy fiche (or copy film) per title of class I in the COM (or other microform) catalog of the old file.

CCFPT(I) = the cost of producing copy fiche (or copy film) per title of class I in the COM catalog of the new or unified file.

CPCFO = the cost per copy fiche (or copy film) for the microform catalog of the old file.

CPCF = the cost per copy fiche (or copy film) for the COM catalog of the new or unified file.

Summing the component costs and taking into account the number of copies of each version of the catalog produced gives the following equation for the COM (or other microform) production cost per title appearance for the old file:

(93) CPTO(I, Y) = CPPTO(I) + CMFPTO(I) + CCFPTO(I) · NCO(Y)

and this equation for the new or unified file:

(94) CPT(I, Y) = CPPT(I) + CMFPT(I) + CCFPT(I) · NC(Y)

where NCO(Y) and NC(Y) are the numbers of copies of the COM catalog produced for each update and supplement for the old and for the new or unified files, respectively.

7.6.2.2 Number of Class I Title Appearances in year Y

Titles appear in various versions of the COM catalog; these versions may be either updates or cumulative supplements. The number of title appearances in fiscal year Y equals the number of updates occurring in year Y times the average number of titles appearing in each update, plus the number of supplements times the average number of titles appearing in each supplement.

For the old file, the total number of class I title appearances in year Y, TTAO(I,Y), is:

(95) TTAO(I, Y) = NUO(Y) · ATTS(I, Y) + NSO(Y) · TSPO(I)

where:

NUO(Y) = the number of updates in year Y of the entire microform catalog of the old file.

NSO(Y) = the number of cumulative supplements of the microform catalog of the old file produced in year Y.

TPSO(I) = the average number of titles of class I appearing in the cumulative supplement of the old file.

For the new file, the total number of class I title appearances in year Y, TTAN(I,Y), is:

(96) $TTAN(I, Y) = NU \cdot ATNMRF(I, Y) + 1/2\ NS \cdot TN(I, S)$.

where:

NU = the number of updates per year of the entire COM catalog of the new or unified file.

NS = the number of cumulative supplements of the COM catalog of the new of unified file produced per year.

For the unified file, the total number of class I title appearances in year Y, TTAU(I,Y), is:

(97) $TTAU(I, Y) = NU \cdot ATT(I, Y) + 1/2\ NS \cdot TN(I, Y)$

* * * * *

We are now able to present the equations for the COM production costs. For the old file, the COM production cost in fiscal year Y is:

$$(98)\quad COMO(Y) = \sum_{I=1}^{NCT} CPTO(I, Y) \cdot TTAO(I, Y) + CORO$$

where CPTO (I,Y) is given by Equation 93, TTAO(I,Y) is given by Equation 95, and CORO is a correction factor which normally is zero but can also represent either a fixed set up cost, or an empirical constant useful for fitting data on COM production prices.

For the new file, the COM production cost* in year Y, COMN(Y), is:

*This equation assumes that NU updates and NS supplements are made in year Y. Because the new file exists for only 6 months in year Y=1, Equation 99 is double what it should be for Y=1.

$$(99)\quad COMN(Y) = \sum_{I=1}^{NCT} CPT(I, Y) \cdot TTAN(I, Y) + COR$$

where CPT(I,Y) is given by Equation 94, TTAN(I,Y) is given by Equation 96, and COR is a correction factor, normally zero.

For the unified file, the COM production cost in year Y is:

$$(100)\quad COMU(Y) = \sum_{I=1}^{NCT} CPT(I, Y) \cdot TTAU(I, Y) + COR$$

where TTAU(I,Y) is given by Equation 97.

7.6.3 Other Costs

The cost in fiscal year Y of delivering and preparing for display copies of the COM catalog equals the cost per catalog delivered times the number of catalogs delivered in year Y. The number of catalogs delivered equals the number of updates plus the number of supplements multiplied by the number of copies produced for each update and supplement. For the old file the cost in year Y of delivering and preparing for display COM catalogs is:

$$(101)\quad CCOMDO(Y) = CDCOM \cdot \left[NUO(Y) + NSO(Y)\right] \cdot NCO(Y)$$

where CDCOM is the average cost of delivering and preparing for display one COM catalog.

For the new or unified file this cost is:

$$(102)\quad CCOMD(Y) = CDCOM \cdot \left[NU + NS\right] \cdot NC(Y)$$

The number of microform readers in the library in year Y, NCOMR(Y), is the cumulative sum of readers acquired in years up to and including year Y:

$$(103)\quad NCOMR(Y) = \sum_{K=1}^{Y} NCOMRI(K),\ Y = 1, 2, 3, 4, 5$$

where:

NCOMRI(0) = the number of microform readers in the library in year 0.

NCOMRI(Y) = the number of microform readers acquired and installed in year Y, Y = 1, 2, 3, 4, 5.

The cost in fiscal year Y of acquiring and installing microform readers is the average cost per reader times the number of readers acquired:

(104) CCOMI(Y) = CICOM · NCOMRI(Y)

where CICOM is the cost of acquiring and installing a microform reader.

The cost in fiscal year Y of the square feet of floor space used for COM readers is the average annual cost of floor space for one reader, CSPCOM, times the number of readers in the library in year Y, NCOMR(Y):

(105) CCOMSP(Y) = CSPCOM · NCOMR(Y)

The cost in fiscal year Y of maintaining the COM readers, CCOMM(Y), is the average annual maintenance cost per reader, CMCOM, times the number of readers:

(106) CCOMM(Y) = CMCOM · NCOMR(Y)

7.7 Cost of On-Line Catalogs

The cost of rental or acquisition of computer hardware in year Y, CROA(Y), is given by:

(107) CROA(Y) = CHWA(Y) + CDA(Y) + CCRENT(Y)

where CHWA(Y) is the cost in year Y of acquiring computer processing hardware (CPU, console, tape drives), CDA(Y) is the cost acquiring disk drives, and CCRENT (Y) is the cost of computer rental. (Appendix A includes a discussion of how these costs may be estimated.)

The cost of operating and maintaining the on-line system in year Y, CCOPMN(Y) is given by:

(108) CCOPMN(Y) = CEO(Y) + CHWM(Y) + CSWM(Y) + CDBM(Y)

where CEO (Y) is the cost in year Y of equipment operators, CHWM(Y) is the cost of hardware maintenance, CSWM(Y) is the cost of software maintenance, and CDBM(Y) is the cost of data base management.

The remaining contributions to the cost of an on-line catalog in year Y are estimated using procedures described in Appendix A and are entered into the model as inputs. These contributions are: CDEV(Y) - development costs, CINO(Y) - installation costs, CTERM(Y) - cost of terminals, and CSP(Y) - costs of space associated with the on-line system.

7.8 Costs of Training and Orientation

The costs of training staff and orienting users in fiscal year Y are also discussed in Appendix A and are entered as inputs. These contributions are: CTTS(Y) - cost of training technical services staff, CTPS(Y) - cost of training public services staff, and COU(Y) - cost of orienting users.

7.9 Cost of Catalog Usage by Non-Cataloging Staff

The cost in fiscal year Y of searches of the catalog by non-cataloging staff equals the average hourly cost of searching multiplied by the hours spent searching during fiscal year Y. The hours spent searching during fiscal year Y equals the product of three factors: 1) the number of searches performed in year Y, 2) the average number of entries checked per search, and 3) the average time to check an entry. Because the old and new files may be quite different, each is accounted for separately. These considerations lead to the following equation for the cost in fiscal year Y of catalog usage by non-cataloging staff:

$$(109)\quad CS(Y)=CSTPH\cdot\left[NSERO(Y)\cdot NECPSO\cdot\frac{TCEO}{3600}+NSER\cdot NECPS\cdot\frac{TCE}{3600}\right]$$

where:

CSTPH = average cost of a staff member per hour

NSER = number of searches per year by staff using the new or unified file.

NECPS = number of entries checked to complete a search in the new or unified file.

TCE = the average time to check an entry in the new or unified file (seconds).

NSERO, NECPSO, TCEO have similar meanings but apply to the old file rather than the new or unified file.

7.10 Cost Adjustments

The cost adjustments provide a vehicle for introducing either costs or savings not accounted for in the preceding equations. Costs are entered with a positive value and savings with a negative value. Contributions to the cost adjustments include the following terms: CPRL(Y) is the cost resulting from non-cataloging personnel reallocation in year Y; CSPR(Y) is the cost resulting from space reassigned in year Y; CED(Y) is the cost resulting from equipment disposition in year Y; and CMISC(Y) is other costs not explicitly accounted for in the cost model.

7.11 Inflation and Present Value

The preceding costs were assumed to be dollars on 1 January 1980 for fiscal years 1981 through 1985; i.e. neither inflation nor discounting were taken into account.

To account for inflation we use the following equation:

$$(110)\quad CI(Y)=\left[1+\frac{ROI}{100}\right]^{Y}\cdot C(Y)$$

where:

C(Y) = a cost component in fiscal year Y expressed in January 1, 1980 dollars.

ROI = the rate of inflation, expressed in percent.

CI(Y) = the inflated cost corresponding to C (Y).

The discounted present value on January 1, 1980 of the cost component C (Y) is:

$$(111)\quad PV = \frac{C(Y)}{\left[1 + \frac{DR}{100}\right]^{Y}}$$

where PV = the discounted present value, and DR = the real discount rate, expressed in percent.

APPENDICES

The following appendices contain edited versions of the basic material sent to the participating libraries in July 1979 to assist them in compiling data to input to the Library Catalog Cost Model:

A. Background Paper
B. General Remarks Concerning the Model and its Inputs
C. Guidance for Preparing Input Form
D. Input Forms
E. Default Figures

Although parts of some of these documents repeat information presented elsewhere in the final report, it is useful to assemble in one place all materials used by participants during the project.

Appendix A was prepared by Richard W. Boss, senior management consultant with Information Systems Consultants, Inc. and a former academic library administrator. It was prepared to assist King Research in the development of the model by providing an overview of the topic and identifying the cost elements that should be included. It later served to give the project participants an understanding of the basis on which the model was built. Figures used in the model were taken mainly from published materials and such unpublished studies as were available from libraries known to have done research related to closing the card catalog. Because the short time period for preparation of the Background Paper (less than 20 working days) and the limited project budget precluded the collection of new data and inclusion of other refinements, many of the figures presented in the paper are only roughly estimated values.

Appendix B provides background material concerning the nature and use of the model. For example, it discusses cost estimation, treatment of branch libraries, and other points not emphasized in the text of the final report.

Appendix C was designed to assist librarians in completing input forms required by the Library Catalog Cost Model. It contains suggested methods for estimating parameters that reflect the costs and operations of individual libraries.

Appendix D contains the input forms used during the Project. These are of two types: one for main or branch runs, and one for combining runs. The form for the main or branch runs essentially parallels Table 2.4, the list of input parameters. The form for combining runs is much simpler. It requires information on what runs are to be combined and what to call the resultant computer run, which produces the sum of the costs of the individual combined runs.

Appendix E contains a list of standard values for parameters required as inputs to the model. To achieve the most accurate results, individual libraries should enter input parameter estimates based on local observations. However, this was not always feasible during the short project schedule and default figures from Appendix E were provided for the use of participants. Most of the default figures were extracted from Appendix A and were assigned reliability ratings (A to C) by the author of the Background Paper.

APPENDIX A

THE FUTURE OF THE CATALOG

Background Paper for the Development of Cost Models
for Alternatives to the Card Catalog

Prepared for King Research, Inc.

by

Richard W. Boss

Information Systems Consultants, Inc.

June 30, 1979

Revised September 28, 1979

THE PROBLEM

The closing of the card catalog is a problem facing every major research library. A number of libraries have committees actively discussing the topic, and a few have already completed preliminary studies. There still remains a great deal of uncertainty about the alternatives available and the technological, financial, political, and time constraints involved.

This background paper will seek to state the problem, identify alternatives and set forth the elements that should be incorporated into a cost model. Known cost data will be provided for use as default figures to assist libraries which lack such information. For purposes of this study, attention will be focused on the main card catalog or union catalog of a library, though the same methodology can and should be applied to decide the future of each branch catalog. This paper assumes that serials are represented in the union catalog, and that large microform sets are included but generally not analyzed. No other categories of nonprint materials are assumed to be included.

"Closing" a catalog means not adding new bibliographic records to it, but continuing to make corrections and deletions. "Freezing" a catalog means not adding new bibliographic records and not maintaining existing bibliographic records. The paper examines both choices, but the general discussion will employ the term "closing."

The idea of closing the card catalog is not new. It has been considered by libraries when each new cataloging code has appeared. The alternatives to the card catalog have been very limited and expensive in the past, so that only a very few libraries have actually closed. Among these few, most adopted book catalogs in the 1960's and computer output microform (COM) fiche or film catalogs in the 1970's. The New York Public Library was the largest research library to adopt a book catalog and the University of Toronto Library the largest to select COM. A combination of circumstances is now compelling large numbers of research libraries to seriously consider the closing of card catalogs after nearly a century of reliance on this form of bibliographic access to their holdings.

A. The Maintenance of Card Catalogs has Become a Serious Problem.

1. Card catalogs are not current in many libraries.

Fluctuations in card production, high turnover in filing personnel and internal staffing priorities all affect a library's ability to handle filing in the main card catalog on a current basis. Many large libraries file first into a temporary catalog and inter-file into the main catalog as time permits. The delay may be three months or more.

2. Card catalogs are often incomplete.

A number of research libraries have not included serials holdings in their card catalogs. Only a few libraries include cards for government documents, microform analytics, and special series such as the Rand Reports. Separate catalogs or finding lists have been created for these materials to improve the currency of records, to reduce costs, or to avoid the filing of cards into the main catalog which do not conform to the cataloging practices adopted by the library.

3. The size of many card catalogs makes them difficult to search, especially by subject.

A catalog with more than two million cards becomes very confusing to library users and staff alike. It is easy to miss a heading, especially when the filing rules deviate from straight alphabetical arrangement. A user sees only one card at a time so it is difficult to get an overview of the filing system.

Users are unsuccessful with the card catalog approximately 16% of the time according to the Lipetz study at Yale[1] and the Palmer study at Michigan.[2] Lipetz found that 62% of the searches were for author, 28.5% for title, 4.5% for subject and 4% for editor. The small number of subject searches resulted in a disproportionate share of the failures.

A study at the University of California at Berkeley concluded that when trying to find an item by subject in the card catalog it is more important to know something about the LC subject heading system than it is to know something about the subject.[3]

4. Card catalogs are full of contradictions because the cataloging rules have been changed a number of times in the 20th century.

Inconsistencies are easily hidden in a large card catalog. A user who finds some information may not realize that there is additional information under one or more other headings.

5. Card catalogs are subject to physical deterioration.

Cards may be torn, smudged, marked up or otherwise soiled. The New York Public Library was the first to launch a massive card catalog restoration project, but other libraries will also reach the point at which catalog cards are no long legible.

6. Cards may be removed by patrons.

It is almost impossible to determine which cards are missing from a card catalog. The removal of single cards, whether done maliciously or in ignorance, will be detected only if a staff member is systematically checking the tracings for a title or a patron complains that a card cannot be found for a book known to be in the collection.

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[1]Lipetz, Ben Ami. User Requirements in Identifying Desired Works In a Large Library. New Haven, Yale University Library, 1970.

[2]Palmer, Richard P. "Computerizing the Card Catalogue in the University Library: A Survey of User Requirements." Research Studies in Library Science, no. 6, 1972.

[3]Bates, Marcia J. "Factors Affecting Subject Catalog Search Success." Journal of the American Society for Information Science, May 1977, pp. 161-169.

7. The cost of maintaining a card catalog has risen dramatically.

In order to maintain the rationality and usefulness of a card catalog a library must not only add new holdings, but also constantly revise headings.

Participation in shared cataloging programs has controlled the rising cost of cataloging and catalog card production, but the cost of catalog cabinets and salaries for filers and filing revisions is now rising at from 6% to 15% per year according to figures from a large research library. The cost of pulling cards for recataloging and changes of headings has also continued to rise dramatically.

In an analysis of three large academic libraries it was determined that 22% of the total cost of cataloging goes into the card catalog and its maintenance.[1]

8. Difficulty of access.

A service problem associated with the use of card catalogs in large decentralized research libraries is the relative lack of accessibility. Patrons and staff must come to a single location to determine the holdings of the library's various collections. The travel time may be ten minutes or more each way.

B. The Anglo-American Cataloging Code, 2nd Edition, Makes Sweeping Changes.

AACR 2 is a set of cataloging rules that treats all types of library materials for general libraries of all sizes. Part I details the rules for developing bibliographic records for materials and Part II contains the rules for choice and form of headings, i.e. author, title, geographic names and uniform titles. Though the changes in Part I will affect cataloging, it is the changes in Part II that will profoundly affect filing in library catalogs.

There appears to be no uniformity in the use of the terms "bibliographic record," "heading," and "entry." These will be used as follows in this paper:

> BIBLIOGRAPHIC RECORD: A record in a card catalog, COM catalog, or on-line data base which describes a book or other title in a library's collection. Each title may have several bibliographic records representing it in a card or COM catalog. Modern methods of card production have resulted in several identical bibliographic records for a title in a card catalog, but the bibliographic records in COM catalogs are often of different lengths. On-line catalogs usually contain only a single bibliographic record, but there will be several indices which lead the catalog user to the record.
>
> HEADING: A filing element, or access element, for a bibliographic record.

[1] Presented by John Knapp at the Seminar "Closing the Catalog: Automated Alternatives to the Card Catalog," November 4, 1977, New York.

ENTRY: A bibliographic record and its associated heading appearing in a catalog together.

The implementation of AACR 2 will represent less of a departure from AACR 1 than a departure from the practices of the Library of Congress and other libraries following the appearance of AACR 1. The practice of "superimposition" attempted to stay the effect of AACR 1 by conforming to the code for entries being newly established, but substituting the form established previously whenever a heading already existed in the catalog. It has been said that the use of superimposed headings means that no single cataloging code is used because old headings are merely copied rather than revised to the new form. Over a number of years "superimposition" has handicapped LC's cooperation with other libraries and the Library has rejected it as a solution to the effects of AACR 2.

The changes in AACR 2 which most affect the form of headings are in the areas of corporate headings, form headings for legal and liturgical materials, and the elimination of differences between choice of access points for monographic and serial works. Even when old catalogs are closed, live serial titles and legal and liturgical works will continue to appear, thus requiring linkages from the old to the new headings, or the transfer of all of these titles out of the old catalog.

Older cataloging codes have tended to prefer the legal or official form of a name, thus requiring a search of reference tools to verify or establish the name. AACR 2 states that the principal source of a name shall be the work being cataloged rather than an external reference source. (AACR 1 already began a move to this pragmatic approach, but superimposition stayed the effect of it.) For example, the offical name "Russell, George William" becomes "A.E." under AACR 2. "Clemens, Samuel" will become "Twain, Mark" even in those libraries that have adhered to the official name after many libraries changed to the better known pseudonym.

The changes in headings for persons are dramatic, but they appear to have less potential impact than the others according to a preliminary study by OCLC.[1] The results suggest that nothing will need to be done with 65% to 70% of the personal names because there is only a single entry for them in the large OCLC data base. Only 10,000 names may have multiple titles associated with them. Presumably a library would not have all of these names, so links to a new catalog or changes in the present catalog would be needed for fewer than 10,000 names.

Within the rules for corporate bodies there are relatively fewer changes, but they may have a far more significant effect on research libraries than the changes in headings for persons. AACR 2 provides that the predominant form of a name be used, and, if there is none, a brief form that would differentiate between the body and others with the same or similar brief names should be used. This would make "AFL-CIO" and "Unesco" the preferred forms for those organizations. The ongoing, extensive publication programs of many organizations such as these may require the changing of many thousands of headings or the development of many linkages. For example, Brown University would have to change 1642 "Unesco" cards. The most direct form of entry is prescribed in AACR 2. For example, "Oxford University" will become the "University of Oxford," a change that will affect 1578 cards in

[1]Personal interview with Fred Kilgour, May 7, 1979.

the main card catalog of the Brown University Library. It was the great changes in the filing position of many headings for corporate bodies which apparently led to the adoption of the policy of superimposition after the appearance of AACR 1, and the problem appears to be a major one again with the appearance of AACR 2.

The decision as to whether to use a uniform title is left by the AACR 2 as a local decision, though if one is used, the rules are dramatically changed. If the purpose of a uniform title is to gather in one place many manifestations of the same work — often in several languages — regardless of the wording of the title selected by the publisher, it is essential that the uniform titles have a strong bias toward the language of the catalog. In most North American libraries that would be English, e.g., Homerus (Odyseseas) becomes Homer (Odyssey). Again direct forms of headings are preferred, so "Jews. Liturgy and Ritual. Hagadah." becomes simply "Haggadah." Similar changes in heading occur in the case of legal works.

Johns Hopkins University undertook a study of the impact of AACR 2 by checking all cataloging done during a single week to determine whether the entries would be the same or different if established under the new rules. There were 295 items cataloged during the week of the sample. Of that number, 93 items, or 25% of the total, would be treated differently under AACR 2 than under the previous rules. Only 16% of the name and uniform title headings would be different, of which 9.6% of the total would be headings already in the catalog. Series headings would be different in 28.6% of the cases, of which 21.4% of the total would already be in the catalog. Of the total number of headings in the sample, 67 were already established in the catalog. From the sample, 2323 new cards would be filed under already-established headings to be changed according to AACR 2, and 360 OCLC records modified. This number would be reduced to 2189 if one interfiled all those headings which would cause only slight confusion, usually headings for conferences and for corporate bodies which differ only by the addition of a place name.

Johns Hopkins University determined that 11% of the headings in their study were substantially different under AACR 2 and were already established in their present card catalog. This figure does not necessariy validate LC's most recent estimate of changes in 11% to 13% of headings because a different relationship was measured. John's Hopkins looked at current cataloging entering its catalog while LC sampled its machine-readable data base.

The Duke University Library did a random sampling of entries already in the main author/title catalog and determined that there were conflicts for 10.8% of the personal headings, i.e. conflicts that could not be avoided by relying on rule options and LC's list of tolerable heading discrepancy categories. There were conflicts for 22.6% of corporate headings. The sample of uniform titles was too small to be statistically significant. Another Duke study determined how many of the titles with conflicts were also represented in the subject catalog. The percentages were 26.6% for personal name headings and 53.6% for corporate name headings. Some 26.7% of the personal name headings in the author/title catalog would require the changing of more than fifteen cards and 64.3% of the corporate headings would require changing more than fifteen cards. The average file size of the corporate headings was 546 cards.

A decision to maintain a single card catalog or a unified catalog in microform would mean that a number of bibliographic records might have to be changed each time a conflict in headings was found. Closing the card catalog and starting a new catalog would require only the creation of cross references or linkages between two catalogs for headings that had changed.

A recent LC analysis of its MARC data base identified 757,574 unique headings of which approximately 498,000 (65.7%) had only been used once. The corporate headings were "normalized" by counting a parent organization with many subordinate bodies under the same broad heading only once. There were, therefore, at least 260,000 headings in the database that had more than one record associated with them. If one assumes that this number will grow to 300,000 by 1980 and that up to 13% of the headings will need to be changed, some 39,000 pairs of linkages would have to be created if the catalog of a library were split into two parts and all linkages were made. Obviously, not all of the headings used in new cataloging would already be in a library's catalog. If existing headings were used in only 60% of new cataloging, AACR 2 caused conflicts would require the use of 23,400 sets of linkages. The University of Michigan Library is conducting an AACR 2 Impact Study to gather data using a methodology based on this type of reasoning.

C. The Library of Congress is Closing its Catalog and Adopting AACR 2.

The Library of Congress, the source of much of the cataloging information used by research libraries, is closing its catalog on January 1, 1981 because the Library is running out of space to accommodate its card catalogs, too much labor is required to maintain the catalogs, many of the catalog cards are deteriorating, and the sheer size of the catalog makes it difficult to revise headings. In conjunction with closing the card catalog, the Library of Congress will adopt AACR 2 and abandon its policy of superimposition, as progress in internal automation at the Library of Congress makes it possible for the Library to close its catalog when it adopts a new set of cataloging rules.

LC's original posture on the adoption of AACR 2 would have required a change in as many as 37% of all headings, with up to 50% of the bibliographic records affected. The latest position announced by the Library of Congress, one of rejecting a number of provisions of the new code, would affect approximately 11-13% of the headings, with some 16% of the bibliographic records affected. Nevertheless, the decision of the Library of Congress goes further than any decision in the past. Previous cataloging codes have been adopted for new entries only; under AACR 2 many changes of old headings will be made.

The Library of Congress and the national libraries of Australia, Canada and Great Britain have developed a list of the AACR 2 options they intend to follow. The Library of Congress has also identified a number of AACR 2 rules and examples that it does not intend to follow because it believes them to be of minor importance yet of great potential impact. The British Library and the National Libraries of Australia and Canada apparently concur. There also appears to be agreement between LC and GPO, which would avoid the problems that LC's policy of superimposition created when different practices were followed by the GPO, publisher of the Monthly Catalog, and other major national libraries.

Among the decisions made by LC are the following:

1. LC will continue to use the abbreviation "Dept." in headings rather than conform to the rule which specifies that the abbreviation not be used. LC's analysis indicated that this term has been used in headings 2,020 times. LC also plans to continue to use the term "House" for the U.S. "House of Representatives."

2. LC plans to continue to use "Great Britian" rather than correcting the term to "United Kingdom." This heading had been used 1,605 times at the time LC analyzed its data base.

3. Headings for persons who have written predominantly under forename initials that were established before 1981 with forenames spelled out in full will normally not be changed to reduce the forename(s) to one or more initials. Exceptions will be made for persons represented on American imprints and for "famous" persons. All headings established after 1980 will reflect the provisions of AACR 2.

LC will continue to use headings that already exist for which the changes outlined would not affect the filing order significantly. However, newly established headings would be done in conformity with AACR 2.

The Library of Congress will retain the old catalog after 1981. The public catalog may be frozen, refiled, and filmed. The new catalog will be an on-line catalog. LC will also temporarily maintain an "add-on" catalog, a card catalog of post 1980 cataloging, until the automated system is fully reliable and the number of terminals to the on-line catalog is great enough to meet the needs of the staff and the public.

LC plans to maintain separate card catalogs of non-roman alphabet materials. These will be eliminated when this data is made part of the on-line catalog. LC has already determined that Cyrillic and Greek will be romanized.

The Library of Congress will close by cataloging date. Any item cataloged after January 1, 1981 will go into the new catalog. Cataloging will be done without reference to the old catalog.

The decision by LC does not mandate that other libraries close their card catalogs, but a decision different from that of LC will increase the time and cost of cataloging. If a library continues with its present procedures after the Library of Congress adopts AACR 2, all entries added to its card catalog(s) would have to be in the AACR 2 form and existing entries not in that form would have to be changed. A library could also decide to ignore AACR 2, but the cost implications of not subscribing to an actively maintained cataloging code appear to be so great that this option has been eliminated from the study as an unwise use of study team resources.

D. Technology has Advanced to the Point of Providing Libraries with Viable Alternatives to the Card Catalog.

Both COM catalogs (microfilm or fiche produced by computer) and on-line catalogs can now be created if a library has machine-readable bibliographic records.

A number of commercial services will produce COM catalogs from archival tapes produced by bibliographic utilities or from other machine-readable data. Several hundred libraries have used these services and their experience is that a budget of $1.00 per title for the development and production of a library's first COM catalog is realistic.

An on-line catalog can be accommodated on a main-frame computer or on one of the mini-computers of the type offered by several of the commercial automated circulation system vendors. The Guelph University Library in Ontario, Canada already has author, title and call number access to more than 800,000 titles on a GEAC mini-computer. Costs are dropping dramatically and experience is still limited, making reliable estimating of costs very difficult, but many small and medium sized research libraries may be able to install an on-line catalog for less than $500,000, including some record conversion.

Book catalogs do not appear to be cost effective when compared with COM catalogs, especially when a catalog is closed but not frozen and new editions have to be produced periodically. Only one major research library is currently maintaining a book catalog, and libraries that have recently investigated this alternative have rejected it in favor of a COM catalog. Several vendors of COM services who also offer book catalogs quote prices for the latter at four to five times the per copy price of the former. One library has calculated the cost of a book catalog as more than fifteen times greater than a COM catalog.

THE ALTERNATIVES

A library may choose to maintain a single, unified catalog after January 1, 1981, or it may close or freeze the existing catalog and begin a new catalog on that date. The alternatives include several formats:

A. Unified Catalog.

1. Card catalog: modify headings and records as needed to conform to AACR 2.

2. Card catalog: follow old cataloging rules at least temporarily.

3. COM catalog: modify headings and records as needed to conform to AACR 2. Conversion of existing card catalog records.

4. On-line catalog: modify headings with an on-line authority control system. Conversion of existing card catalog and/or COM records.

Using AACR 2 entries for new cataloging and filing them in the existing catalog with cross references between old and new forms is really creating two catalogs in one. Only minor savings in space and card catalog cabinet costs will be realized.

B. Split Catalog.

5. Freeze existing card catalog; start new card catalog under AACR 2.

6. Freeze existing card catalog; start new COM catalog under AACR 2.

7. Freeze existing card catalog; start new on-line catalog under AACR 2.

8. Close existing card catalog; start new card catalog under AACR 2.

9. Close existing card catalog; start new COM catalog under AACR 2.

10. Close existing card catalog; start new on-line catalog under AACR 2.

11. Freeze existing card catalog and convert it to microform. Start new card catalog under AACR 2.

12. Freeze existing card catalog and convert it to microform. Start new COM catalog under AACR 2.

13. Freeze existing card catalog and convert it to microform. Start new on-line catalog under AACR 2.

14. Close existing card catalog and convert it to microform. Start new card catalog under AACR 2.

15. Close existing card catalog and convert it to microform. Start new COM catalog under AACR 2.

16. Close existing card catalog and convert it to microform. Start new on-line catalog under AACR2.

COSTS OF THE CARD CATALOG

A library must carefully analyze its reasons for closing its card catalog. Not all of the problems cited earlier are common to all libraries. The fact that the Library of Congress has decided to close its card catalog does not mandate that other libraries do so, although the decision will exert great pressure to do so -- especially financial — as illustrated in this section.

The costs associated with the card catalog fall into two catagories, the preparation and filing of the card catalog records, and the maintenance of the records after they are filed. There have been very few studies on these costs. Most of the studies in the literature were done in the late 1960's and deal with the entire cataloging process, giving scant attention to what was, at the time, perceived to be the least costly part of the process.

One study which did enumerate the costs of card production and filing was done by R & D Consultants Company[1] in 1969. It drew on work done at several large public, academic, and special libraries. Composite figures from the study are cited in several of the following sections.

[1] Reported in Dolby, J. and Forsythe, V. J. "An Analysis of Cost Factors in ning and Updating Card Catalogs," Journal of Library Automation, December 218-241.

A. New Records

1. Catalog Card Production

The cost of producing cards after the preparation of the cataloging copy has been completed ranged from $.064 to $.079 per card in 1969. These costs were averages that included the in-house production of cards and the purchase of LC printed cards. The average number of cards per title in large research libraries was 9. By 1979 almost all libraries acquired their cards from bibliographic utilities at an average cost of $.04 per card. The average card set for a research library of medium size was just under seven cards according to OCLC, Inc.

We recommend that libraries which lack local cost data use $.145 as the current cost of a locally-produced catalog card (exclusive of cataloging which averages in excess of $17.00 per title). The card cost is based on doubling the costs of 1969 and the data from two research libraries. The cost of cards produced by bibliographic utilities averages $.04 each.

2. Filing Cabinets and Reference Tables

It is assumed that typical 60-drawer card catalog cabinet when 60% filled contains 43,200 cards (based on the R & D study) and costs $1,800; the initial cost of storage per card is $.04. If there is one $500 reference table for each four catalog cabinets, the additional cost per card would be $.0029. These costs are nearly double those reported in the R & D study in 1969.

3. Floor Space

Library construction costs have now risen to $80 per square foot in much of the U.S. The typical 60-drawer card catalog cabinet requires 6 square feet of space and at least 24 square feet of additional space for users. Thus the space cost for a single cabinet would be $2,400, or $.055 per card. On an annual basis the cost would probably be 5% of the construction cost, assuming a twenty year amortization.

4. Sorting and Filing Labor

The R & D study reported filing costs of $.042 to $.052 per card. The higher cost figure is from the New York Public Library with its very large, complex catalog; most institutions clustered near $.043. Telephone queries made recently of two libraries confirmed an initial estimate based on doubling these 1969 figures. A crude division of the salaries of filers (plus 20% for benefits) by the number of cards filed produces a figure of $.085 per card. This is an unburdened cost, i.e. does not include the cost of facilities, administrative overhead, filer training, or direct supervision.

No cost figures for sorting and preliminary filing prior to filing have been found, but if one assumes that it would be just over 10% of the cost of filing, the figure would be $.01 per card. This is only a rough estimate at this time.

5. Revision Labor

The professional revision of cards filed by clerical personnel cost the Princeton University Library $.024 per card in 1977. The University of California at Berkeley recently estimated $.03 per card. We recommend $.03 per card as a default figure.

B. Maintenance of Records

1. Periodic Expansion of the Card Catalog

An expansion of the card catalog will normally be undertaken every five to ten years and may involve the addition of 15% to 30% more filing space. The amount of labor required is more closely related to the total size of the catalog than to the number of drawers being added. From 500 to 1,000 hours will be required in a library with over 2,500 catalog drawers at an average cost of $5.00 per hour, according to data from Cornell, Princeton and Stanford.

If the cost must be translated into a cost per 60-drawer cabinet expanded, we recommend $90.00 (based on 750 hours). We prefer $12.00 per 60-drawer cabinet per year.

2. Pulling of Cards

The Library of Congress has estimated that 5% of the cards filed in its catalog in any one year will have to be pulled at a later date for updating or correction. This figure seems low. One large research library's catalog maintenance unit pulls nearly 1% of its cards each year. This would be far more than 5% of the year's filing. No other estimates could be found in the literature. We recommend the use of 1% until more data becomes available.

If one assumes that pulling can be done at the same rate as filing (except that no revision is required), the cost would be $.085 per card. This cost would, of course, become very significant were a library to choose to maintain a unified card catalog after adopting AACR 2.

3. Physical Changes in Catalog Cards

RLIN members can call up their own records and make changes. OCLC members cannot now do so, thus requiring them to go through the full procedure for creating a record. OCLC expects to give libraries on-line access to their own records some time in 1980. Costs have not yet been announced.

Only a small percentage of the records that must be changed will be in a machine-readable data base. Erasing headings and retyping them may cost as much as $.08 per card if 1968 University of Utah costs are adjusted for inflation. We recommend the use of that figure.

4. Refiling Labor

The refiling of cards will not be as great as original filing if many cards for the same heading are corrected and refiled at one time. If one assumes a 50% unit cost reduction, the cost per card would be $.06 per card, including sorting, filing and revision.

5. Authority Work

The intellectual costs of determing which headings to change, how to change them, and what cross reference to make is not reflected in any of the above. We have no default figure to recommend at this time and suggest that study participants be asked to share what information they may have.

6. Records Change Under AACR 2

We estimate that a major research library will have at least 100,000 personal name headings in the catalog (based on a University of Virginia authority file count), of which 34% will have been used more than once. If 13% of those headings used more than once were to be in conflict under AACR 2, records for 4% or 4,000 personal name headings would have to be changed. The average number of titles produced per author with more than 2 titles is 7.3 according to a recent University of Illinois study. We, therefore, estimate that at least 233,600 cards would have to be changed. The actual number would be greater due to multiple editions of titles.

We estimate 35,000 corporate headings in a typical research library's catalog, of which 40% will have been used more than once. If 13% of the headings used more than once were in conflict, and the average number of cards per heading were over 300 (based on a University of Pennsylvania sample), the total number of cards to be changed would be 546,000. This corporate heading data is much less reliable than the personal name heading data.

The cost of these record changes can be significantly reduced by making linkages for the headings under which many records are filed. These linkages would be similar to those described in the next section for a split catalog.

CLOSING AND FREEZING THE CATALOG

There are two major options available to libraries which decide to close their catalogs, but in each case there would continue to be changes in the old catalog to reflect the acquisition of new volumes of sets or series and changes in locations. Even libraries which record holdings and locations in a separate file would probably continue to remove cards for materials withdrawn from the collection.

A. Closing by Imprint Date

Older materials would be filed in the existing catalog and newer materials in its replacement. The division would depend on the imprint date given by the publisher. It would mean that the old catalog would have to be maintained indefinitely for the addition of works issued before the closing date. Cut-off by imprint date is not as simple as it may appear. The University of Toronto has found that patrons often do not know the imprint date of a publication. Double look-up is, therefore, often necessary.

B. Closing by Cataloging Date

All materials cataloged before the closing date would remain in the existing catalog and all those after that date in its replacement, regardless of the date of publication. Users would, therefore, not be certain which catalog would contain works published before the closing date and might have to consult both catalogs.

A library might not close all of the card catalogs in its library system uniformly. The larger catalogs would be the most likely to be closed because they have usually been maintained in close conformity to a code. In smaller units, in which it is already common to modify standard cataloging, it may be possible to modify existing records to conform to the new code without increasing present costs significantly.

C. Freezing the Catalog

Freezing the catalog cannot be done by imprint date because a library will always be acquiring older works. Nor can it be frozen by cataloging date without removing the cards for all active serial titles. Large research libraries would have to transfer from 100,000 to more than 500,000 cards to the new catalog before freezing the old catalog.

D. Linking the Catalogs

The development of linkages between two catalogs may be undertaken by filing cross references from all headings in the old catalog to their AACR 2 counterparts in the new catalog, and by including cross references in the new catalog to direct users to related but different headings in the old catalog.

Headings on cards need not be changed when the old catalog is closed and a new one started. The cost of linkages is, therefore, related to the number of headings that must be changed, not the number of bibliographic records affected. There may be many bibliographic records associated with a single heading. If a unified catalog is maintained, the cost is related to the number of cards that must be changed.

A library may choose to make no links between the old and new catalogs. Instead, the library could insert general reminders at intervals in each catalog referring users to the other catalog. This would eliminate the need of checking the old catalog when cataloging a work that is to be entered in the new catalog and it would eliminate the preparation of filing of cross references. If a retrospective conversion were later done, there would be no obsolete references from the new to the old catalog.

The Library of Congress is considering the sale of cross reference or linkage cards in complete sets[1], but it may be mid-1980 before a decision is reached. A magnetic tape of the linkages created by LC will probably be made available to

[1]39,000 sets of headings. An Illinois sample of its filing backlog determined that 51.54% of headings would hit headings already established. If 13% were in conflict, some 6.7% of the average number of headings of a research library would require linkages in the first year. We believe 175,000 headings would be typical for a research library of two million volumes, thus requiring 9,975 pairs of linkages.

libraries and bibliographic utilities. It appears highly likely that cards will be available from some source. Even at $.04 each they would be economical. We recommend the $.04 figure for the model.

The library would still incur a significant filing cost. If this were done on a project basis, the cost might be half that of the regular filing cost of $.06 per card, including sorting, filing, and revision.

E. Retraining of Staff and Users

Any decision to split the catalog, whether a split between two card catalogs or a split involving at least one machine-readable catalog, will require revision of manuals and handbooks, some training and orientation sessions, and some public relations. Any such effort could take as little as $1,000 or as much as several thousand dollars. We recommend $1,500 for staff retraining and $1,000 for orienting users as default figures, but we also recommend that each library develop its own figures based on the numbers of staff and users, and on local perception of needs.

MICROFILM AND MICROFICHE CATALOGS

Catalogs in card format can be microfilmed by commercial firms for approximately $5,000 per million cards, including the provision of equipment, supplies, and labor for filming and the processing, boxing, and labeling of the film. That figure does not provide an updating capability other than supplements. Microfilming is only a satisfactory solution if the catalog is to be frozen and the library wishes to reproduce it in multiple copies in a more compact format.

It is more common for libraries to produce a microfilm or microfiche catalog from machine-readable data using COM (Computer-Output-Microform). It is likely that many of the libraries that wish to create an on-line catalog will not be able to do so by January 1, 1981. They may close the existing catalog and establish an interim catalog in microform. The contents should be replicated in machine-readable form. The interim catalog need exist only as long as it takes to install an on-line system; the interim catalog could be eliminated at that time so library users would not have to use three separate catalogs.

To facilitate the discarding of an interim catalog all of its records should exist in machine-readable form. The old catalog would, therefore, have to remain open for those records not in machine-readable form. For most libraries this material would be primarily non-roman script material.

The cost components of producing a COM catalog are: record conversion or new record production, computer processing, production of one master copy, and the duplication of service copies in the quantity required by the library. The retrospective records conversion is a one-time cost, but the other expenses are incurred each time a new catalog is produced.

A library must decide whether the machine-readable record that is to be used to create the COM catalog is to contain the data, tags, and subfield indicators of the MARC II format, or an index that will allow reference or conversion to or from a MARC II format. The library could facilitate future interlibrary cooperation by a decision to maintain MARC II compatability.

A. Retrospective Conversion

Conversion from card catalogs into machine-readable form is expensive. Keying the data from shelf list cards costs approximately $1.36 per card, exclusive of MARC tagging, if one uses the keying costs of commercial data entry organizations as a guide. Most libraries have, therefore, limited their COM catalogs to the titles for which machine-readable bibliographic records are already available. This may change as the bibliographic utilities begin to encourage retrospective conversion projects using the shared cataloging data bases. OCLC now makes no First Time Use (FTU) charge for retrospective conversions, and has estimated that the current cost to the library is $.07 per record using its system. This was the Florida COMCAT union catalog cost.

A library should not assume that a COM catalog can be generated directly from an archival tape supplied by a bibliographic utility. The MARC communications format developed by LC was designed to facilitate the transfer of records among data bases. It is not an internal operating format. Considerable work is required to use MARC records from other sources to create a COM catalog. Duplicate occurrences of the same item must also be eliminated.

Before the construction of a data base for the production of a COM catalog can begin, the library must decide whether to undertake the project within the institution or whether it will use an outside service agency. The approaches to budgeting are quite different because the service agencies have pricing policies that recover a large percentage of their fixed costs from the first 100,000 records they process for a customer. There are also marketing costs and profits included in the service agency figures. Nevertheless, the prices are firm and the quality is highly predictable. A COM catalog can be started within 60-90 days using a service agency.

B. In-house Production

1. Computer Processing

The University of California at Berkeley has apparently done the most extensive recent study of using existing campus facilities for producing a COM catalog. They have estimated a cost of $1.50 per thousand access points for computer processing. The cost figure is based on a quotation from their computer center and apparently does not include equipment amortization and all labor costs.

2. Master Fiche Preparation

The cost calculated by University of California at Berkeley is $1.05 per master fiche of 60 lines. They have estimated 7 lines per full bibliographic record and 3 lines per brief bibliographic record.

3. Service Copies

The University of California at Berkeley has estimated $.075 per fiche for service copies.

The costs for computer processing six million access points (for a typical large research library this would be 667,000 titles) would, therefore, be $9,000. If each bibliographic record were full and there were an average of nine for a title, the catalog would consist of 3900 fiche. The cost would be $4,095 for the master fiche and $292.50 for each service set. The cost could be reduced by having only one full bibliographic record for each title and brief records at the other points of access. Berkeley has estimated that the file would be reduced to 2400 fiche with a cost of $2,520 per master and $180 for each service set.

These figures assume that all of the needed equipment is available and none of its costs is to be charged to the COM catalog project. Overhead costs are also not included, nor all labor. True costs are, therefore, higher.

C. Outside Service Agency

The vast majority of COM catalogs produced to date have been done by one of several commercial firms: Autographics, Baker and Taylor, Blackwell North America, Brodart, and Science Press. We contacted several of these firms and their prices have been generalized for the following sections. These prices are likely to be reduced in a competitive bidding situation.

1. Computer Processing and Master Fiche Production.

Commercial services generally quote this as part of a package price. For example, two firms say they will prepare COM catalogs from existing machine-readable records for $.06 to $.10 per record or title, including computer processing (often called conversion by vendors), a master fiche copy, and a small number (2-5) of service copies.

On June 27, 1979 we finally obtained a breakdown of one vendor's price structure:

a. Changing from the MARC communications format of an OCLC archival tape to the operating format for a library's machine-readable record: $.05 per title.

b. Computer processing of the data base and the creation of a master fiche: $.04 per title.

This vendor does not adjust its price for the length of the bibliographic record or the number of bibliographic records per title in the COM catalog. They have determined that the vast majority of customers have comparable requirements.

We recommend a default figure of $.09 per title for computer processing and the creation of a master fiche from machine-readable records when a library is going to include 200,000 or less titles in the COM catalog. Larger quantities can be looked up in the tables on the following pages.

The vendors will also accept records prepared by what is called the short-entry method. The short-entry conversion procedure is the most commonly used approach next to the processing of an archival tape from a bibliographic utility. The library

staff types a short entry consisting of the author, short title, call number, LC card number (if available), and location information from its shelf list. The entries are typed on an OCR (Optical Character Recognition) element-equipped typewriter. The vendor reads these records into its data base, ideally a MARC data base, and matches an author, title, and LC card number. All of the apparent matches are printed out for review by the library and, if approved, are subsequently used to create the library's machine-readable data base. The cost of this matching is an additional $.09 per record for matches against a MARC data base and $.30 additional per record for matches against another data base. The cost can, therefore, be as low as $.15 or as high as $.40. We recommend $.37 per record.

A circulation data base can also be matched against a service agency's data bases. The results are usually not quite as good as with the short-entry method described above because the quality of most circulation data bases is uneven.

Full entry typing is necessary for all the records that cannot be matched. This is usually from 20 to 40% of a research library's holdings. All keying that must be done costs the library additional money. A figure of $1.95 per 1000 characters is a reliable estimate. A number of data entry services offer their customers these rates and several of the COM service agencies quote the same rates.

Charges for producing the master film or fiche when a very large conversion from a MARC-formatted data base is done would be:

Titles	Charges
250,000	$11,475
300,000	13,350
350,000	15,085
400,000	16,680
500,000	19,450
600,000	21,720
700,000	23,380
800,000	24,480
900,000	25,020
1,000,000	25,000
2,000,000	50,000

These costs would include computer processing, but not the preparation of duplicates.

If the library chooses to enter only partial information using OCR equipment and has the vendor match against available machine-readable data bases with full bibliographic records, the charges are typically:

Titles	Charges
250,000	$ 89,350
300,000	105,900
350,000	122,115

400,000	137,800
500,000	168,000
600,000	196,500
700,000	223,230
800,000	251,600
900,000	283,050
1,000,000	314,500
2,000,000	629,000

The short-entry typing can be accomplished at the rate of 100 titles per hour according to vendors experienced in library conversion projects.

If a library has no machine-readable records available, but can key complete bibliographic information on OCR equipment, the charges typically would be only sightly more than with the provision of an archival tape (but the costs in the library would be six times higher than keying brief entries):

Titles	Charges
250,000	$13,850
300,000	16,200
350,000	18,445
400,000	20,500
500,000	24,250
600,000	27,600
700,000	30,380
800,000	33,600
900,000	37,800
1,000,000	42,000
2,000,000	84,000

In addition to this start-up cost, a library will incur annual catalog maintenance charges based on the number of new titles added. The charges for converting from a machine-readable data base and from brief records sent in on OCR produced cards are:

Titles Per Year	Machine-Readable	OCR
20,000	$ 900	$ 3,200
25,000	1,125	4,000
30,000	1,350	4,800
40,000	1,800	6,400
50,000	2,250	8,000

COM fiche and film are both available. For those who choose COM film, there is an extra charge of up to $.025 per frame for the master and up to $.05 per foot for duplication per copy.[1]

2. Service Copies.

The number of copies produced will vary by the number of library users in the library each day and the number of locations a library has. Five copies is the minimum for a central library and as many as eighty may be desirable. The

[1]Toronto reports 7 feet of film per fiche for their catalog.

University of Toronto Robarts Library has ten film catalogs for high-use locations and seventy fiche catalogs. The ratio of catalogs to daily users is aproximately 1:300.

Frequency of appearance also affects the cost. A typical annual cost schedule for a COM fiche catalog produced four times each year is:

Titles	5 Copies	25 Copies	50 Copies	100 Copies
250,000	$ 985	$ 3,385	$ 6,000	$ 12,000
500,000	1,816	6,000	12,000	24,000
1,000,000	3,016	12,000	24,000	48,000
2,000,000	4,800	24,000	48,000	96,000

A frequency of six times per year would add 50% to the above charges. Most libraries chose four to six publications per year.

D. Data Base Maintanence Costs

There are costs associated with the intellectual activity of maintaining the machine-readable data base, especially with the authority work. We have not identified any cost studies, but we would expect such costs to be substantially lower than with a card catalog because consultation of the records is so much faster.

The most significant advantage of a catalog based on machine-readable records is the ease of alteration. If an authority control file is linked with the bibliographic records, a single change in the authority control file can update all bibliographic records. The cost comparison of the maintenance of any catalog based on machine-readable records with a card catalog is even more important than the comparison of the creation of the records initially because it is in maintenance that the greatest cost savings may be realized.

We are continuing to research this question but suggest a figure of $.10 per heading change as a work figure. We had hoped RLIN would have some data as part of its planning for on-line authority control, but no figures were available as late as September, 1979.

E. Acquisition of Microform Reading Equipment

Good quality microfiche readers can be purchased for $250 each. A microfilm reader will cost at least $800. Consulting tables or counters will add $400 per unit to the cost, and fiche stands another $65 per unit. Fiche holders cost $5 for 48 fiche capacity.

F. Maintenance of Equipment

Microfiche readers can be maintained for less than $25 each per year. Microfilm readers will cost an average of $100 each to maintain per year.

G. Floor Space

Each COM reader requires 25 square feet, including user space.

H. Electrical Modifications

Providing additional outlets for microform reading equipment will average $50 per reader unless, as is sometimes necessary in older buildings, additional power must be drawn from a remote part of the building. Drawing from a remote power source may add $1,000 per building to the cost.

I. Cost of Training Staff and Orienting Users

The University of Toronto Library spent several thousand dollars developing and giving special training and orientation when it adopted a COM catalog. The costs included a special video-tape introduction to the system. Carole Weiss, Head of UT's Reference Department, says the elaborate preparations were not necessary. Users and staff took rather naturally to the new catalog. Therefore, it may be possible to incorporate instruction and orientation into existing programs. We suggest that the model include some costs: $1,500 for staff training and $1,000 for user orientation as a minimum, with the exact figure to be determined by each library.

J. Network Service

SOLINET has begun to offer COM services to its members. Its prices average about 35% lower than the for-profit service agencies. The pricing formula is quite simple: $.02 per record for computer processing, $.02 per record for creating the master fiche, and $.09 per service copy. The prices are based on the allocation of all costs, including equipment acquisition, among twenty customers. SOLINET has the computer processing done by Blackwell North America, but does all of its own microform production. The network also acquires microform readers at discount for members.

Several other regional networks are investigating the establishment of similiar programs. UTLAS is the only bibliographic utility offering COM services. The others have not yet announced their plans.

THE ON-LINE CATALOG

An on-line catalog is one that can be accessed by a library patron as well as a staff member by entering an author, title, call number, or subject query on a keyboard. The response should occur in no more than eight seconds and is displayed on a visual display unit associated with the keyboard.

An important benefit of adopting an on-line catalog is that one can unify the catalog with order and in-process files. The economics of merging files must be considered.

The costs associated with an on-line catalog include:

A. Retrospective Conversion

The costs for conversion are usually budgeted at $1.00 per title, although bibliographic utilities quote from $.67 to $1.75 per title. OCLC allows retrospective conversion to be done without an FTU charge and quotes the lowest total cost per

title for the library. RLIN has no charge for entering a title during retrospective conversion that is new to the data base if it meets the network's standards; the charge is $1.30 if it does not. RLIN is planning a special conversion rate for drawing on records in the data base. The figure will probably be below $1.00 per record. UTLAS quotes the highest rate but justifies it on the basis of lower long-term cost to the library because data base quality and authority control are allegedly superior.

B. Computer Processing

The library that creates an on-line catalog today will normally have to process archival tapes from a bibliographic utility before it can create a usable data base. All of the utilities are moving toward the support of on-line catalogs by having authority control on-line and by modifying their data bases. OCLC probably cannot accommodate the equipment expansion such a program would require until after its new building is completed in 1981. RLIN and WLN should have the capability in 1980. Once on-line authority control is available, additional processing may be negligible and the costs of file maintenance should be extremely low compared with the maintenance of a card catalog. We recommend a cost of $3,000 per 100,000 titles for computer processing of archival tapes to prepare them for use in an on-line catalog.

C. Acquisition of a Central Processing Unit or Sharing a Unit with Another User

H. A. Vervliet has provided some estimates in his article in International Cataloging (Jan.-Mar. 1977, pp. 6-8) entitled "Alternative Physical Forms of Catalogues in Large Research Libraries." When adjusted for changes in prices and improvements in computing power, one would have to budget over two million dollars for start-up costs for large main-frame configured systems[1] and annual operating costs of several hundred thousand dollars. Mini-computers could do the job for one-third the cost. Some libraries are too large for mini-computers, however. That is why the treatment of computer hardware will be divided between the two approaches.

Cornell University Library has estimated the start-up cost of an on-line catalog using a DEC PDP 11/70 mini-computer, including 2 tape drives, 1 high-speed printer, 20 low-speed printers, and 600 MB of disk storage at $310,000, plus $40,000 in site preparation, communicating, and supplies. They have also estimated 25 terminals at $4,000 each for an additional $100,000. Maintenance costs for the computer system are estimated at $40,000 per year.

After five years and a total expenditure of $1,000,000 for hardware, supplies and labor, an on-line catalog containing the last ten years of cataloging would have been built. It would include more than half million titles accounting for an estimated 40% of the collection usage. These figures seem high when compared with the costs incurred by Guelph University Library. Guelph has all 800,000 volumes of its holdings available on-line. The Central Processing Unit is a GEAC 8000 mini-computer. The CPU costs $80,000 and the two 300 MB disk drives $30,000 each. The brief bibliographic records use up only two-thirds of one disk drive, but the other is required as back-up. The 31 terminals cost $2,600 each. Development costs added another $100,000 to the system.

[1]The small main frame computers recently announced by IBM will reduce these costs and may become an excellent intermediate solution for libaries.

The total start-up cost[1] for Guelph was $320,000 and provided the library with an integrated system that includes circulation; on-line author, title, and call number access; acquisitions; and local cataloging. Another library might not replicate the system at the same price because Guelph realized some discounts under a joint development agreement for the circulation software. Nevertheless, the total figure of $500,000 mentioned earlier may be achievable. Annual operating costs at Guelph have been $150,000 as compared with the $110,000 estimated by Cornell for its extended five year development period.

Neither of these estimates assumes a back-up for the central processing unit. Guelph has had less than 1% down-time, but it has excellent maintenance. A library should seriously consider whether it is willing to accept 2 to 3% down-time, or whether it is willing to spend $43,000 to $80,000 for a second CPU to back up the first.

It is possible to increase the capacity of a mini-computer system by connecting two CPU's together and having them share the storage. The Van City Credit Union of Vancouver, B.C. has more than 1,500 terminals and a huge data base on such a system. It is extremely difficult to predict the performance of such a system in a library environment.

Main-frame developments are more difficult to describe. Those at Chicago, Northwestern, and Stanford all have required several years and cost several million dollars, but all were begun when the costs of computing were much higher than today. We have greatest confidence in a recent confidential study by a major research library which assumed that it would cost more than $1,000,000 to develop a system in-house and that the most cost-effective way to proceed would be to purchase another library's or library utility's software package and develop it for use on a main-frame computer. The least expensive main-frame would have cost $1,000,000 to purchase, but the library opted to use an existing computer available on its campus. The lowest cost alternative for software development was the purchase of the most expensive software package, but the one which would require the least further development. The costs for the option selected are estimated at $350,000 for the software development and $250,000 per year for operation, exclusive of hardware costs.

The choice of central processing unit is most dependent on the number of terminals the library plans to have, the amount of storage required, and the type of activities undertaken on the system. We have consulted several computer manufacturers and have developed the following schedule based on the assumption that a library would have a high volume of subject searching once patrons and staff discover how easy and attractive it is compared with subject searching in a card catalog. Subject searching places great demands on a computer system.

Mini-Computer			Main-Frame Computer	
Under 16 Terminals	16-64 Terminals	64-256 Terminals	Under or over 256 Terminals Dedicated CPU	Shared CPU
$60,000	$75,000	$95,000	$1,000,000	$200,000

[1]Record conversion had been completed earlier and was not charged to this project.

The above figures include not only the CPU, but also the system console, a high speed printer, and a tape drive. The shared cost for the main-frame was arbitrarily pegged at 20%. Of course, this may not be charged back to the library.

D. Disk Drives

Storage costs depend on the length of bibliographic records chosen and on the percentage of the disk storage capacity one decides to use. We have observed poor performance when library committed more than 50% of storage capacity for bibliographic records. The balance needs to be left for indexes, overhead, etc. We have, therefore, developed the following schedule based on the use of at least four disk drives, half of them 50% loaded, and the other half for backup.

Mini-Computer		Main-Frame Computer
Under 100,000 full or 200,000 brief records	Under 500,00 full or 1,000,000 brief records	Per 250,00 full or 500,000 brief records
$33,000	$73,000	$27,000 (plus $50,000 for disk controller)

The smallest configuration would use 60 megabyte (MB)[1] drives and the others 300 MB drives. The mini-computer systems are limited to four such drives. The mini-computer prices include the disk controller. The prices are common bid prices, rather than the "quantity one" prices quoted by disk manufacturers.

E. Software Development

Several vendors of turn-key systems are developing on-line catalogs; one has already quoted a price for the software package. Other costs in the following schedule are estimates based on a number of interviews.

Mini-Computer Software			Main-Frame Computer Software	
Turn-key	Software House	In-House	In-House	Transferred Software
$50,000	$200,000	$250,000	$1,000,000	$350,000

*A megabyte is one million characters of storage capacity.

F. Terminals

The Guelph University Library will soon bring its number of public terminals to 40 for a ratio of terminals to daily attendance of 1:175. A number of staff predict that the number will have to be increased to 60 or a ratio of 1:117. We believe that the higher number of terminals will become necessary when patrons discover the advantages of an on-line catalog search. We also believe that patterns of library use will change. Why should someone go to the main library to check the catalog once an on-line catalog to most of the recently processed collection is available at a nearby branch library? We strongly recommend that the software include record keeping of terminal activity so units may be moved around until optimum utilization is achieved.

Terminals vary in price from $900 to $5,000. We recommend a default figure of $2,600 because that is the cost of the most popular terminals used in libraries. Table or counters for terminals must also be budgeted. We recommend an additional $400 per unit.

G. Installation

Installation costs vary dramatically with the age of the building and the condition of the electrical system and air conditioning. Mini-computers require at least four 30 AMP dedicated circuits for the CPU and the disk drives and two 15 AMP circuits for the console and printer. Air conditioning that is comfortable for staff is adequate for a mini-computer, but it must be year-round. The temperature cannot go above 85 degrees even one or two days a year.

The costs for main-frame computers are much higher because they require more power and their temperature tolerance is much less. A minimum schedule would be:

Mini-Computer			Main-Frame Computer	
Under 16 Terminals	16-64 Terminals	64-256 Terminals	Under or over 256 Terminals Dedicated CPU	Shared CPU
$7,500	$9,500	$13,000	$35,000	$18,000

Installations in older buildings (pre-1960) are normally double the above costs. Another $50 should be added for each terminal over 10 for electrical outlets.

H. Floor Space

The space required by a mini-computer is normally 150 square feet for the central site. Each terminal requires an additional 25 square feet of floor space including space for the user.

I. Hardware Maintenance

One rule of thumb stipulates annual hardware maintenance costs of 5% of the capital investment. We have encountered a range of 3 to 8%. We recommend the 5% figure.

J. Software Maintenance

Turn-key system vendors combine hardware maintenance, software maintenance, and software enhancement into a single package which normally does not exceed 8% of the capital investment each year. We have estimated annual software maintenance at 3% of the initial system cost in calculating the following annual costs for turn-key systems. The others are based on prices quoted by companies surveyed.

Mini-Computer Software		Main-Frame Computer Software	
Turn-key	Software House	In-House	Dedicated or Shared
$14,000	$40,000	$50,000	$100,000

K. Staff Training and User Orientation

At least 15 hours of training per staff member should be budgeted. Manuals should be prepared and concise graphics for each terminal. A minimum outlay would be $10,000, but most of that would be staff time that might be absorbed in the regular work schedule. Patron orientation is partly a matter of public relations and partly a matter of the complexity of the system and the degree to which patrons will use it themselves. A minimum of $1.500 in expenses should be used as the default figure, with each institution determining its own figure based on local needs.

L. Network Service

A library may opt to wait for the bibliographic utilities to offer on-line catalog services. Such services may be generally available by 1983-84.

OCLC is considering the acquisition of an existing turn-key circulation system in 1980 for use as a "front-end" to its system. The utility would own the CPU in the library and the library would own the terminals. OCLC could then develop and maintain the total system to assure compatibility. A CPU might be shared among several libraries to achieve optimum utilization of equipment. As a library added the on-line catalog to its circulation system, the CPU requirements would increase, but it would not have to buy a new CPU because OCLC could reconfigure the network of computers. The library would pay for its use of the circulation system and on-line catalog in the same way that it now pays for cataloging services, by usage charges.

UTLAS also envisions this type of "distributed" system. It has already developed its own circulation system and on-line catalog. The first installation has recently been made at the University of Toronto Undergraduate Library. The installation is a "stand-alone" at this point, it is not yet electronically linked to the mainframe computer at UTLAS. UTLAS will sell its sytem and will subsequently charge only for connect time to the utility's mainframe.

WLN plans to provide an interface to each library's own system, but current development is limited to an interface with the turn-key system marketed by Data Phase.

RLIN has not announced its plans beyond committing itself to on-line authority control, an essential component of an on-line catalog. RLIN hopes to obtain funding for a two-year trial of a public access system to determine the functional requirements, costs, and user behavior patterns of an on-line catalog before it markets its system. It will probably be a distributed system of some type, however.

The thinking of all the utilities has moved toward distributed systems because circulation and on-line catalogs involve unique local files and patterns of activity which usually require only short bibliographic records. There is a very high level of interaction with the computer in both circulation and catalog access by the public. A library would not want to incur communications costs to a utility's mainframe with each transaction.

The large cataloging data base of full bibliographic records, which can most efficiently be stored in a large mainframe computer system and shared among many libraries, is of great importance to circulation and on-line catalogs, however. The common data base can be used to create the short records for the local data base. It can also be called up by the occasional on-line catalog user who wishes to see the full bibliographic record.

THE ISSUE OF FULL RECORDS

The cost of maintaining full bibliographic data at all access points in a COM microfiche or microfilm catalog or in an on-line catalog is significant and possibly not justified. A partial record that is MARC-compatible, but limited to main entry, title, year of publication, call number, location, subject headings, LC card number and ISBN or ISSN would require approximately 300 characters as compared with 700 characters in a full MARC record, according to a recent Georgia Institute of Technology Library estimate.

Two libraries that have considerable experience with alternatives to the card catalog, Ohio State University and the University of Toronto Library, have undertaken "quick-and-dirty" studies to determine whether users of an on-line catalog (OSU) or a COM catalog (UT) need a full bibliographic record. The Ohio State University study data identified only 2% of the users as going to the full bibliographic record, a figure that may be confirmed by a library school study under way at the University of Toronto.

The University of Toronto COM catalog is arranged in four separate sequences: shelf list order, author, title and subject. The full bibliographic record appears only in the shelf list section. The other listings are brief. Use of the shelf list was made by less than 10% of the users in 1977 and that percentage appears to be dropping. Many of the users interviewed said they used the shelf list approach as a classified subject approach rather than to get full bibliographic details.

A library could choose to rely on published bibliographic tools for full bibliographic information, or it could provide the complete record at only one access point in a COM catalog. Main entry would be the preferred access point because librarians and users are accustomed to this approach in the case of CBI, Wilson indexes and several other printed bibliographies. Toronto, however, has found that title is sought slightly more often.

The data elements that might be included in the brief or partial record are:

Call number
Main entry
Uniform title (if any)
Edition
Imprint
Series statement
Subject headings
LC card number
ISBN

CATALOG USE

There is virtually no data available on catalog usage, i.e. how many people typically use a catalog and the average time for a catalog search.

Cornell University measured card catalog use from April 5 - May 2, 1976 and found that 199 to 429 users per hour were at the main card catalog of Olin Library between 9:00 a.m. and 4:00 p.m. daily. The maximum number of users at one time was 21, a circumstance that occurred only once. Nearly 96% of the time there were 14 users or less.

Toronto has conducted a finding-time experiment. Their approach to the results is a cautious one because they made adjustments for users who started a search at the wrong unit of a divided catalog. Each of 30 volunteers, both staff and patrons, searched a list of 32 items against card, COM film, and COM fiche catalogs. They used different search orders. The average search time was 37.3 minutes at the card catalog, 41.6 minutes at the film catalog, and 41.7 minutes at the fiche catalog. The best time was 21 minutes at the card catalog by a librarian. The fastest film searcher, also a librarian, took 24 minutes and the fastest fiche searcher, a library technician took 26 minutes. The slowest search was a 203 minute film search by a library technician. That person took 72 minutes with fiche and 54 minutes with the card catalog. The film file was the first searched. The results may have been affected by inadequate knowledge of filing rules. While the results are not conclusive, they suggest that there may not be dramatic time differences for searching between COM and card catalogs.

We observed on-line searching by patrons by author, title, and call number at the Guelph University Library for a period of one hour. The average search for author and title was less than 20 seconds, but call number searches varied a great deal because some users were seeking information about specific items and others were using the approach as a browsing tool.

Careful research is needed, but we believe the following can be used as default figures: card catalog search, 70 seconds; microform catalog, 80 seconds; on-line catalog, 20 seconds.

NON-COST FACTORS

A decision to close the card catalog and start a new one has far more than financial implications. There are technological, attitudinal, and time elements to be considered as well. Any decision that is made must also be consistent with the

service philosophy of the library. The cost of using information technology will be higher if emphasis is placed on ease of use and training and orientation than if standard equipment is installed.

A. Technology

COM technology is well developed. Hundreds of libraries are using it. The on-line catalog will represent a new application of a technology that has until recently not been successfully used in large libraries for a much simpler application — circulation systems. The first libraries to install large on-line catalogs will undoubtedly encounter unexpected delays, reliability problems, and cost overruns before the systems are fully satisfactory. This is in large part due to the fact that the distribution or mix of activities will not be known until after the system has been installed. Response time will be particularly sensitive to a large number of terminals being used simultaneously for subject searching. It is highly likely that the amount of subject searching in an on-line catalog will be far greater than that in a card catalog.

B. Attitudes

Carole Weiss of the University of Toronto Library has reported[1] that user perceptions of their needs and wants are often incorrect. Library users surveyed before the closing of the catalog at UT in 1967 were looking for a specific item 77% of the time and said in 85% of the cases that they would look first under author. In fact, some 33% looked by title and 30% by topic when they were observed using the catalog.

Those surveyed favored a computer catalog (37%), a book catalog (30%), or the retention of the card catalog (26%), but very few (6%) favored a microform catalog, even though that was the library's first choice based on the state of technology and the costs of available alternatives. Ms. Weiss observed: "Their negative reactions to a microform catalog seemed generally based on past experiences in trying to consult newspapers on microfilm."

The statements of users cannot, therefore, become the principal basis for a library's choice. A library will have to anticipate outspoken criticism of a decision contrary to the expressed views of its patrons. The Prince George's County Memorial Library System has been the most candid in reporting negative reactions to their COM film catalog. The Library averaged 15 complaints a week in 1977 that too many machines were out of order, it took too long to scan the 780 foot reels of microfilm to get to the desired bibliographic records, and the image was not sharp enough. Staff were also quite unhappy. The library then tested COM film and fiche side by side and let staff and patrons recommend which form should be used. Over 85% of the more than one thousand patrons and 97% of the staff said fiche is easier to use. The study results conflict with the choices of users in other libraries. The explanation advanced is that the participation in the choice the second time was a major factor in shaping the more positive attitudes to a second change in the catalog.

[1]Weiss, Carole. "Card Catalogue to On-line Catalog — The Transitional Process," Planning for the Future of the Catalog. Washington, D.C., ARL, 1978.

The most detailed study of COM catalog users was done for the Los Angeles County Public Library in 1976[1]. Over 600 patrons were asked to rate card, book and COM film catalogs. Over 75.8% said they were favorable to the COM catalog and 10.9% were unfavorable. The greatest negative response on the COM catalog was tied to look-up time. Almost 25% of the patrons insisted that it took more time to use the COM catalog than the card catalog, although 41% said that it took less time. The University of Toronto has determined that there was a very positive response to the COM catalog after its installation. They had launched an elaborate staff training and patron orientation program as part of the change over from a card catalog.

Patrons in libraries with automated circulation systems are very vocal about system down-time. Most on-line systems in libraries are available 97% or more of the time, but some large libraries have suffered 10 to 50% down-time for weeks at a time. Response time has also been a problem in some large libraries. Anything over 8 seconds seems to trigger a rash of complaints.

Staff may be even more negative, especially when the objectives for introducing technology are unclear and concern about loss of jobs arises. The only actual reduction in staff attributable to technology that we found documented in the literature was that of Cleveland Public Library when it reduced programming staff after changing from an in-house batch system to a turn-key on-line system. More commonly, staff has been transferred. Nevertheless, fear of job loss can be great and may require extensive discussion during the planning stages for the installation of a new system.

While a number of libraries have cited cost reduction as a benefit of automation before installing a new system, almost none subsequently report cost reduction. Improved service and cost control are almost always cited in articles which appear after the installation.

Higher level administration must be fully committed to the program and must understand that costs, times, and results cannot be predicted exactly. There has to be a willingness to accept the consequences of failure. An outside vendor of hardware can be late in equipment delivery, software bugs may elude the most able analysts for months, or system performance may be different than predicted.

C. Time Required

A library can launch a COM catalog of those holdings for which it has machine-readable data in as little as three to six months. This would include preparation of the files, equipment acquisition, site preparation, and staff training. A very large research library should plan to take at least 12 months. Toronto made its decision 12 months before starting the new catalog and committed thousands of hours in staff and committee work to accomplish the objective within that time.

The creation of an on-line catalog will require a minimum of 12 to 36 months. The 12 month period will probably be possible for those libraries which have a signficant machine-readable data base who wish to install a turn-key mini-computer

[1]Butler, Bret et al. Library and Patron Response to the COM Catalog: Use and Evaluation. Los Altos, California, Information Access Corp, 1978.

system. Libraries with existing in-house systems staff and access to a main-frame computer may be able to launch an on-line catalog in 24 months. Based on experience at a Midwestern university, a minimum of 6 staff-years should be budgeted. Libraries which must still recruit a staff for an in-house development should plan at least a 36 month development period.

D. Service Philosophy

The service philosophy of the library will determine the balance between cost and level of service. The cost will rise if the library is committed to eliminating the use of multiple files; the cost will also rise if a library chooses to update records frequently; and it will rise if equipment is modified to facilitate ease of use.

Sensitivity to ease of use does not always cost money, however. Color-coding the function keys on a computer terminal cuts training/orientation time by more than half, yet there is usually no extra charge. Vendors had sold over 10,000 terminals before the first customer specified color coding.

The development of a set of objectives is needed to guide the new catalog project. Typical statements might include:

1. There shall be a complete union catalog in all library locations.

2. No one shall have to wait more than 30 seconds (1 minute, 2 minutes) for access to the catalog.

3. There shall be an average of 7 access points for each title.

4. The catalog shall be current to within x days (weeks or months).

5. All staff and patrons shall be trained in the use of the catalog so that the form of the catalog will not be a barrier to collection use.

The design and implementation of a training program is one of the major decisions a library must make. One may choose to look on it as a public relations issue.

The University of California at Berkeley Committee on Public and Staff Relations has recommended that the Catalog Supplement and Serials Union List be distributed to a select number of academic departments for the following reasons:

1. Public relations - to demonstrate the utility of micro-catalogs and to indicate the direction in which the library is moving.

2. Learning experience - to increase the experience of users and to aid library staff in further development of instructional techniques.

3. Feedback - to receive information from the faculty and others concerning the advantages and disadvantages of the micro-catalogs.

A library may also decide what to do, plan the implementation, and then launch a detailed multi-phase program. For example, the University of Toronto undertook the following three-phase training and orientation program when it closed its catalog:

1. General Orientation Sessions

One hour illustrated lectures for all staff in groups of 100. The program included an overview of advances in computer technology, a description of the new program, a review of the implications of computer access to catalog information and discussion of the impact of the new technology on library jobs.

2. Practice (Hands On) Sessions

Small groups (less than 10) of people with similar job assignments. Sessions were at 3 levels:

(a) Basic - for those who do not use catalogs in their daily work;

(b) Intermediate - for those who use catalogs sporadically;

(c) Advanced - for those who use catalogs regularly as a function of their jobs.

Each staff member was expected to demonstrate mastery of the new catalog access forms by successfully searching for several types of catalog entries.

3. Feedback Sessions

The Practice Session Groups were called back to discuss their responses to increased library automation and any problems they had with the new system.

Toronto also issued a special Newsletter during the implementation period. A section of every issue was devoted to questions and answers ranging from the energy consumption levels of microform readers to concern about users' abilities to adapt.

Toronto alerted people all over the campus by printing posters and mailing brochures to all faculty and staff. A video-tape describing the new system was also prepared. A free-standing 8"x5" flip chart was placed next to each microform reader containing 9 pages of explanation about the finding and interpreting of entries. A five minute audio-tape was also prepared and placed in a tape player next to each flip chart.

The flip charts were the principal source of information about the new catalog for both graduate and undergraduate students. Faculty relied most on the brochure that had been mailed to them. The special orientation sessions reached only a small percentage of the users, far less than relied on either reference staff or other users. The listening facility was used by only 5%.

APPENDIX B

GENERAL REMARKS CONCERNING THE MODEL AND ITS INPUTS

COSTS

1. The Library Catalog Cost Model considers the costs incurred by a library over a planning period of five fiscal years, 1981 through 1985. Fiscal year 1981 starts on July 1, 1980 and ends on June 30, 1981. This choice was made to enable libraries to use certain statistics, such as number of titles held by the library, available for June 30 of previous years. These five fiscal years are indexed by the variable Y, with Y = 1, 2, 3, 4, 5 corresponding to 1981 through 1985.

2. All cost figures entered into the model should be in dollars on January 1, 1980. January 1 falls in the middle of the fiscal year and should be representative of costs during that fiscal year. After the major cost elements in the model have been estimated in 1980 dollars in each of the five years of the planning period, they are adjusted for 0 to 10 percent inflation for presentation in the table of output costs. In addition the present value is computed using a 10 percent discount rate applied to the expenditures (in 1980 dollars) in each of the five years and displayed in the table of output costs. Since the five year cost with no inflation equals the present value for a zero discount rate, the cost results also reveal the difference between the present value computed using a 0 to 10 percent discount rate.

3. Cost estimates entered into the model for labor should be standard unit costs*, and should include not only the cost of performing the activity, but also the cost of non-productive times (such as coffee breaks), inefficiencies and variations in work loads, and fringe benefits (holidays, vacation, insurance, social security, etc.).

FILES

4. Old and New Files. Under the assumption that AACR 1 will be in force until December 31, 1980 and that AACR 2 will be implemented after January 1, 1981, one naturally obtains a split catalog consisting of two parts:

   a. The old file - which contains the bibliographic records of titles cataloged prior to January 1, 1981.

   b. The new file - which contains the bibliographic records of titles cataloged after January 1, 1981.

*See Chapter 4 of Hayes, R.M. and Becker, J., Handbook of Data Processing, Second Edition, Los Angeles: Melville Publishing Company, 1974.

5. The Form of the Files. The records stored in a file may be in several forms: cards, microform images, or machine readable records. These records may be displayed on cards, microform readers or computer terminals. Microform readers may display stored records either directly (e.g., when a card catalog has been replaced by microform images of the cards) or indirectly (e.g., when machine readable records are used to produce a COM catalog).

ALTERNATIVES

6. The model provides estimates of costs to the library for several different basic alternatives. These basic alternatives are indicated in Table 2.1.

7. Each basic alternative determines which cost elements appear in the output from the cost model, and which input parameters are required to compute these cost elements.

8. By varying parameter values within a basic alternative, one can represent a wide range of different physical situations. By fixing the set of parameter values for a given basic alternative, one can represent a specific physical situation which we shall call a particular alternative. To obtain a cost estimate for a particular alternative of interest, the library must submit for entry into the computer a set of input parameter values which characterize that alternative. A computer run converts the set of inputs into the cost estimates. For a given basic alternative, it it possible to estimate costs for several different particular alternatives by changing the values of the input parameters. Under basic alternative 4, the split card catalog, for example, one may consider any of the following options by changing the values of appropriate parameters:

    1. Freeze or close* the old file (i.e., the existing catalog)
    2. Provide links in one direction
        a. from old file to new file
        b. from new file to old file
    3. Provide links in two directions

    Option 1 is affected by parameters affecting the intellectual and physical work of maintaining the old file. Freezing the old file implies that the cost associated with this work is zero. Closing the old file implies that these costs are not zero. Options 2 and 3 are affected by parameters dealing with (1) the number of conflicts resolved and treated by heading changes, by linkages, etc., and (2) the costs for these types of treatment. Therefore, when the input form is being prepared, the particular alternative under consideration should be kept firmly in mind to make sure that the values entered for each parameter truly characterize that alternative.

*Freezing a catalog means adding no new entries and making no corrections or deletions. Closing a catalog means adding at most a limited number of entries by continuing to make corrections and deletions. If a catalog is closed according to the cataloging date, no new entries are added; if it is closed by imprint date, only entries with sufficiently old imprint dates are added. Our model assumes that no new entries are added to a closed catalog.

COMBINATIONS OF ALTERNATIVES

9. Treatment of Branches. The central concern of the library catalog cost model is the treatment of cataloging at the main library. Accordingly, the main computer run should consider the costs associated with cataloging at the main library.

10. If all the branches of the library adopt the same alternative regarding the future of the catalog, they may be viewed as a single aggregated operation whose costs fall into the framework of the Library Catalog Cost Model. A supplementary computer run, therefore, can be used to estimate costs associated with this single aggregated operation. In assembling the inputs for this supplementary run, care should be exercised to ensure that costs already counted in the main computer run are not included in the supplementary run; the supplementary run estimates costs that are incremental to those of the main catalog. The combined costs of the main library and branch libraries can be obtained by applying the COMBINE function to the outputs from the main and supplementary runs. (The COMBINE function merely adds together costs of the individual runs and is described in the computer program description.)

11. If the branch libraries adopt more than one alternative, then they may be grouped according to which alternative they adopt. For this situation each group of branch libraries with a common alternative may be viewed as a single aggregated operation; and a supplementary computer run should be made for each group. The combined costs of the main library and the branches, again could be obtained by applying the COMBINE function to the outputs from the main and supplementary runs. For example, suppose that a library has 15 branches. The main library and 10 branches choose to close their card catalogs and install an on-line public access catalog. The remaining 5 branches choose to adapt their existing card catalogs to AACR 2 and continue with a unified card catalog. This situation leads to three computer runs: the main run, a supplementary run for the ten branches that choose an on-line catalog, and a supplementary run for the 5 branches selecting a unified card catalog. The COMBINE function would be applied to these three runs.

12. Concurrent Operations. A library may decide that more than one alternative is to be implemented at one time. For example, a library may decide to maintain a non-roman alphabet card catalog and have an on-line catalog for its other holdings. The costs in this case may be computed in a similar manner to that used to treat branches. The on-line alternative would be treated by the main run, the non-roman card catalog would be treated by the supplementary run, and the COMBINE function would total the results for the main and suplementary runs. (Caution should be exercised to ensure that the inputs for the supplementary runs represent incremental costs; i.e., costs not included in the main run.)

THE NUMBER OF HEADINGS IN THE LIBRARY

13. The number of headings plays a very important role in estimating the impact of AACR 2 on the costs of the various alternatives. The headings affected by AACR 2 include personal and corporate names, and uniform and series titles. Therefore, in this project the term headings includes personal and corporate names and uniform titles and excludes topical subjects. None of the libraries visited to date have been able to obtain estimates for the three required input parameters dealing with the number of headings: (1) the total number of headings for class I titles in the library on January 1, 1981, (2) the annual rate of growth of this number, and (3) the number of headings associated with newly cataloged titles.

14. This lack of information concerning the number of headings has led us to develop the notion of the number of unique headings per title for a set of N titles. This quantity is denoted by UHPT(I,N). When we consider a single title, then N is 1 and the number of unique headings per title, on the average, is approximately 1.5, i.e., UHPT(I,1) = 1.5. As the size of the set of titles considered, N, increases, there is a tendency for some of the headings to overlap so that the number of unique headings per title will decrease. For a very large collection of titles, such as the Library of Congress, it has been observed that a new heading must be added for every two new titles. Hence, when N is on the order of millions, UHPT(I,N) is approximately 0.75. We have developed a preliminary version of the curve for the unique number of headings per title for a set of titles versus the number of titles in that set (i.e., UHPT(I,N) versus N), and would appreciate receiving any data or references you might have on this subject to improve the accuracy of this curve.

15. From this curve one can estimate the total number of headings in a library from the total number of titles in the library. In addition, the growth in the number of headings per year can be estimated from the growth in the number of titles per year; and the number of headings associated with the number of newly cataloged titles can be estimated from the number of newly cataloged titles.

CLASSES OF TITLES AND TYPES OF BIBLIOGRAPHIC RECORDS

16. The Library Catalog Cost Model is capable of distinguishing between different classes of titles and different types of bibliographic records. The classes of titles are indexed by I = 1, 2, 3, ..., NCT, where NCT is the number of different classes of titles. For example, if we wish to distinguish between monographs and serials, then NCT = 2 and I = 1 denotes monographs, and I = 2 denotes serials; if we wish to distinguish between English language monographs, foreign language monographs, serials, and microforms, then NCT = 4, I = 1 denotes English language monographs, I = 2 denotes foreign language monographs, I = 3 denotes serials, and I = 4 denotes microforms. The types of bibliographic records are indexed by J = 1, 2, ..., NTR(I), is the number of different types of bibliographic records for titles of class I.

UPDATES AND CUMULATIVE SUPPLEMENTS

17. By an update of the COM catalog we mean that all the records that have been entered into the machine readable file are processed to produce an up-to-date COM catalog of the entire file. By a cumulative supplement we mean a relatively brief catalog which contains only those records entered into the machine readable file since the last update. For example, if we have a semi-annual update on January 1 and July 1 with cumulative monthly supplements, then the first cumulative supplement would contain records entered in January; the second cumulative supplement would contain records received in January and February; etc. An ordinary (non-cumulative) monthly supplement would contain records entered in January for the first supplement, records entered in February for the second supplement, etc. The Library Catalog Cost Model considers only updates and cumulative supplements; ordinary supplements are less desirable because they require more look-ups.

APPENDIX C

GUIDANCE FOR PREPARING INPUT FORM

Introduction

To apply the Library Catalog Cost Model, a library must first select one of the 12 basic alternatives listed in Table 2.1, and then estimate the numerical values of the set of parameters required by that alternative.

The set of parameters required by each alternative is specified by the input parameter/alternative incidence matrix presented in Table C.1. This matrix consists of 0's and 1's and has the following meaning: 0 indicates the input parameter is not required for the particular alternative selected, and 1 indicates that the input parameter is required for the particular alternative selected. This matrix is helpful for identifying the set of input parameters that must be evaluated for a particular alternative.

The input form, Appendix D is, in effect, a union list of parameters required for the 12 basic alternatives. All of these parameters appear in Table 2.4 with the following exception:

1. Run identification information (items 1 to 4)

2. An indication of which options are selected. (See items 10a, 10b, and 27 of the input form.)

3. The number of classes of titles to be considered, NCT, and the number of types of bibliographic records to be retrospectively converted, NRT, (items 5 and 15).

The information mentioned in these three exceptions is required for every alternative.

Before completing the input form, it is suggested that items not required for the alternative selected (i.e. those parameters that have a zero in Table C.1) be crossed off of the input form.

The remainder of the Guidance will proceed sequentially through the form. Each parameter will be discussed and the equation containing that parameter will be identified.

Table C.1 INPUT PARAMETER - ALTERNATIVE INCIDENCE MATRIX

Input Element		Alternatives											
		1	2	3	4	5	6	7	8	9	10	11	12
1	TN	1	1	1	1	1	1	1	1	1	1	1	1
2	TTO	1	1	1	1	1	1	1	1	1	1	1	1
3	TNCFS	0	0	0	1	0	0	1	0	0	1	1	0
4	TNMRFS	1	1	1	1	1	1	1	1	1	1	1	1
5	TW	1	1	1	1	1	1	1	1	1	1	1	1
6	HTO	1	1	1	1	1	1	1	1	1	1	1	1
7	HT	1	1	1	1	1	1	1	1	1	1	1	1
8	NHN	1	1	1	1	1	1	1	1	1	1	1	1
9	CCPT	1	1	1	1	1	1	1	1	1	1	1	1
10	CEOPT	0	0	0	1	1	1	1	1	1	1	1	1
11	CECPT	1	0	0	1	0	0	1	0	0	1	1	0
12	CEMRPT	0	1	1	0	1	1	0	1	1	1	1	1
13	CCPR	1	1	1	1	1	1	1	1	1	1	1	1
14	RC	1	1	1	1	1	1	1	1	1	1	1	1
15	RCO	1	1	1	1	1	1	1	1	1	1	1	1
16	CACPT	1	1	1	1	1	1	1	1	1	1	1	1
17	CRCPC	1	1	1	1	1	1	1	1	1	1	1	1
18	PCTHC	1	1	1	1	1	1	1	1	1	1	1	1
19	PCTL	1	1	1	1	1	1	1	1	1	1	1	1
20	CHCPR	1	1	1	1	1	1	1	1	1	1	1	1
21	CLPH	1	1	1	1	1	1	1	1	1	1	1	1
22	RPH	1	1	1	1	1	1	1	1	1	1	1	1
23	FHCS	1	1	1	1	1	1	1	1	1	1	1	1
24	NHC	1	1	1	1	1	1	1	1	1	1	1	1
25	K	0	0	0	1	1	1	0	0	0	1	1	1
26	KN	1	0	0	1	0	0	1	0	0	1	1	0
27	CCL	1	0	0	1	0	0	1	0	0	1	1	0
28	FK	1	0	0	1	0	0	1	0	0	1	1	0
29	CN	1	0	0	1	0	0	1	0	0	1	1	0
30	CFSPC	1	0	0	1	0	0	1	0	0	1	1	0
31	CMPC	1	0	0	1	1	1	1	0	0	1	1	1
32	FM	1	0	0	1	1	1	1	0	0	1	1	1
33	CPCB	1	0	0	1	1	1	1	0	0	1	1	1
34	SQPC	1	0	0	1	1	1	1	0	0	1	1	1
35	CCAB	1	0	0	1	0	0	1	0	0	1	1	0
36	CSQ	1	0	0	1	1	1	1	0	0	1	1	1
37	CEPC	1	0	0	1	0	0	1	0	0	1	1	0
38	PBCE	1	0	0	1	0	0	1	0	0	1	1	0
39	NCOMRO	0	1	0	0	1	0	1	1	1	1	0	1
40	NCOMRI	0	1	0	0	1	0	1	1	1	1	0	1
41	NCO	0	0	0	0	0	0	1	1	1	0	0	0
42	NC	0	1	0	0	1	0	0	1	0	1	0	1
43	NUO	0	0	0	0	0	0	1	1	1	0	0	0
44	NSO	0	0	0	0	0	0	1	1	1	0	0	0
45	NU	0	1	0	0	1	0	0	1	0	1	0	1
46	NS	0	1	0	0	1	0	0	1	0	1	0	1
47	TSPO	0	0	0	0	0	0	1	1	1	0	0	0
48	CERPT	0	1	0	0	1	0	0	1	0	1	0	1
49	CSRPT	0	1	0	0	1	0	1	1	1	1	0	1

Table C.1 INPUT PARAMETER - ALTERNATIVE INCIDENCE MATRIX (cont'd)

Input Element		Alternatives											
		1	2	3	4	5	6	7	8	9	10	11	12
50	CMRPT	0	1	0	0	1	0	1	1	1	1	0	1
51	NFRPTO	0	0	0	0	0	0	1	1	1	0	0	0
52	NSRPTO	0	0	0	0	0	0	1	1	1	0	0	0
53	LPFRO	0	0	0	0	0	0	1	1	1	0	0	0
54	LPSRO	0	0	0	0	0	0	1	1	1	0	0	0
55	CPRO	0	0	0	0	0	0	1	1	1	0	0	0
56	LPFO	0	0	0	0	0	0	1	1	1	0	0	0
57	CPMFO	0	0	0	0	0	0	1	1	1	0	0	0
58	CPCFO	0	0	0	0	0	0	1	1	1	0	0	0
59	CORO	0	0	0	0	0	0	1	1	1	0	0	0
60	NFRPT	0	1	0	0	1	0	0	1	0	1	0	1
61	NSRPT	0	1	0	0	1	0	0	1	0	1	0	1
62	LPFR	0	1	0	0	1	0	0	1	0	1	0	1
63	LPSR	0	1	0	0	1	0	0	1	0	1	0	1
64	CPR	0	1	0	0	1	0	0	1	0	1	0	1
65	LPF	0	1	0	0	1	0	0	1	0	1	0	1
66	CPMF	0	1	0	0	1	0	0	1	0	1	0	1
67	CPCF	0	1	0	0	1	0	0	1	0	1	0	1
68	COR	0	1	0	0	1	0	0	1	0	1	0	1
69	CMCOM	0	1	0	0	1	0	0	1	0	1	0	1
70	CDCOM	0	1	0	0	1	0	0	1	0	1	0	1
71	CICOM	0	1	0	0	1	0	0	1	0	1	0	1
72	CSPCOM	0	1	0	0	1	0	0	1	0	1	0	1
73	CSP	0	0	1	0	0	1	0	0	1	0	1	1
74	CHWA	0	0	1	0	0	1	0	0	1	0	1	1
75	CDA	0	0	1	0	0	1	0	0	1	0	1	1
76	CTERM	0	0	1	0	0	1	0	0	1	0	1	1
77	CDEV	0	0	1	0	0	1	0	0	1	0	1	1
78	CINO	0	0	1	0	0	1	0	0	1	0	1	1
79	CEO	0	0	1	0	0	1	0	0	1	0	1	1
80	CHWM	0	0	1	0	0	1	0	0	1	0	1	1
81	CSWM	0	0	1	0	0	1	0	0	1	0	1	1
82	CDBM	0	0	1	0	0	1	0	0	1	0	1	1
83	CCRENT	0	0	1	0	0	1	0	0	1	0	1	1
84	CTTS	1	1	1	1	1	1	1	1	1	1	1	1
85	CTPS	1	1	1	1	1	1	1	1	1	1	1	1
86	COU	1	1	1	1	1	1	1	1	1	1	1	1
87	NSERO	1	1	1	1	1	1	1	1	1	1	1	1
88	NSER	1	1	1	1	1	1	1	1	1	1	1	1
89	NECPSO	1	1	1	1	1	1	1	1	1	1	1	1
90	NECPS	1	1	1	1	1	1	1	1	1	1	1	1
91	TCEO	1	1	1	1	1	1	1	1	1	1	1	1
92	TCE	1	1	1	1	1	1	1	1	1	1	1	1
93	CSTPH	1	1	1	1	1	1	1	1	1	1	1	1
94	CPRL	1	1	1	1	1	1	1	1	1	1	1	1
95	CSPR	1	1	1	1	1	1	1	1	1	1	1	1
96	CED	1	1	1	1	1	1	1	1	1	1	1	1
97	CMISC	1	1	1	1	1	1	1	1	1	1	1	1

In the upper left hand corner of the form please give the name and phone number of someone we can contact in case any difficulties arise.

RUN IDENTIFICATION

1. Print your library's name. Use no more than 72 characters, counting blanks.

2. This input identifies the particular run you are making in three ways:

   a. Your run number, starting with 1, 2, etc.
   b. Your type of run: main, branch, combination, or other.
   c. Your own words describing the run.

The first three characters of RID are reserved for your run number. The fourth character is reserved for the type of run, using this code: M means main library, B means branch, C means combination main/branch, and N means none of the above. The remaining characters - 5 through 72 - are reserved for your own words describing the run. For example, your first run might be identified by:

001M JEFFERSON LIB: FREEZE OLD, LINK NEW TO OLD.

Your second run would start with 002, etc. Although a total of 72 characters is allowed for RID, only the first 20 will be used in a comparison table of cost estimates for your various alternatives.

3. Insert the date of mailing the inputs, in this form month/day/year (e.g., 8/10/79).

4. Refer to Table 2.1 to specify the basic alternative number which fits the run you are preparing.

GROWTH OF TITLES

5. How many different classes of titles do you wish to consider? If one class is sufficient, then set NCT=1, and identify the class of titles considered to the right of "I=1"; e.g., they might be identified by "all titles". Also cross out the rows for I=2 and I=3. If you with to distinguish between monographs and serials, set NCT=2 and then set up this code:

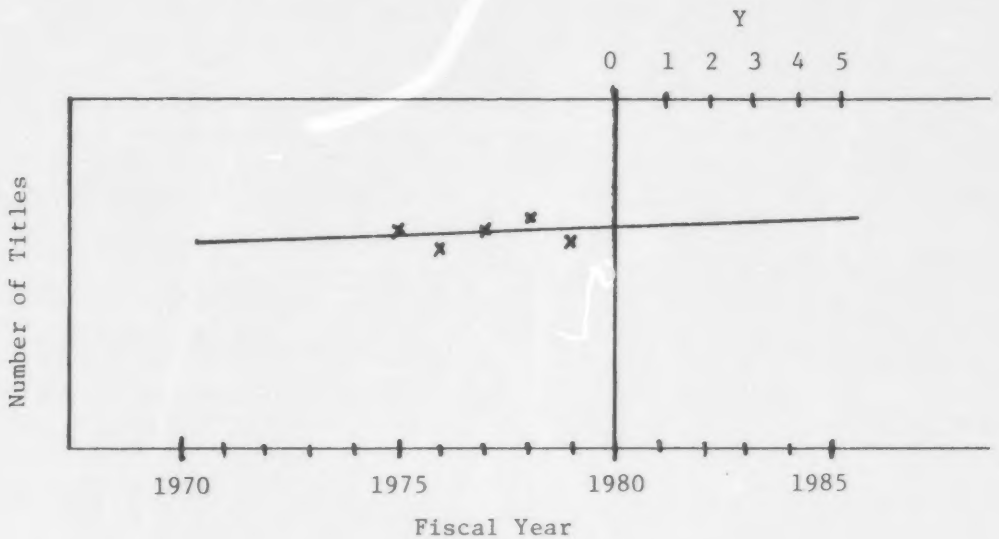
I=1: Monographs

I=2: Serials

Cross out the row for I=3. If you wish to distinguish among three classes of titles, set NCT=3 and assign meanings to I=1, 2, and 3. The disadvantage of choosing a value for NCT of two or more is that more input values must be prepared. To keep the input form to a reasonable size, we have allowed NCT to be as large as 3 so that for many parameters in the input form, we have I=1, 2, and 3. If you have set NCT=1, do not use the spaces provided with I=2 and I=3 for all parameters in the input form. If you have set NCT=2, do not use the spaces provided with I=3. If you wish to use a value of NCT greater than 3 (a possibility that seems remote at this time), then please extend the input form to suit your needs; cutting and pasting extensions is one possible approach. At present NCT must not exceed 4.

6. TN(I,Y). To obtain the number of titles newly cataloged in year Y for each class of titles considered, it is suggested that library statistics for the number of newly cataloged titles be collected for the past 5 to 10 years and plotted on graph paper versus the year as shown in Figure 1. Remember that Y=1 denotes fiscal year 1981, July 1, 1980 to June 30, 1981, etc. From this information and other budgetary information concerning anticipated acquisition expenditures over the next few years, project the values of TN(I,Y) to June 30, 1985. (Equations 2, 3, 6, 7, 10,12, 13, 18, 19, 29, 57, 78.)

Figure C.1. Number of Newly Cataloged Titles Per Year



7. The total number of cataloged titles of class I in the library on June 30, 1980, TTO(I), is the sum of the number of cataloged titles in the library on June 30, 1979 (a figure available to most libraries) and the number of newly cataloged titles for fiscal year 1980, estimated in item 6. If the number of titles is a figure not available at a library, it can be estimated by dividing the number of volumes (which hopefully is available) by the average number of volumes per title. A rough estimate for the number of volumes per title is 13 for serials and 1.2 for monographs. (Equations 1, 2.)

Another way of estimating the total number of titles in the library is to measure the number of inches of cards in the shelf list catalog and multiply this number by the number of cards per inch. The number of cards per inch is approximately 100. This estimate can be further refined by dividing the number of cards in the shelf list by the number of shelf list cards per title (approximately 1.03.)

8. The number of titles of class I in the new card file on January 1, 1981 TNCFS(I), should be estimated only for those alternatives where there is a split catalog and where the new file is in card form. See Table 2.1. When a new card file is started on 1 January 1981, TNCFS(I) is normally 0. Procedures similar to that used for estimating TTO(I) may be used to estimate TNCFS(I). (Equations 12, 13, 16.)

9. The number of titles of class I in the new machine readable file on January 1, 1981, TNMRFS(I), should be estimated only for those alternatives where there is a split catalog and where the new file is in machine readable form. See Table 2.1. This quantity accounts for the number of machine readable records built up prior to 1 January 1981 from a retrospective conversion (RECON) project or from OCLC (or other network) tapes. This figure should be available from your computer records. (Equations 18, 19.)

10. The number of titles of class I withdrawn from the library catalog in year Y, TW(I,Y), accounts for losses and removals. By assumption, all of these withdrawals are made from the old file. Estimates for this quantity can be derived from library statistics when available, or from the percentage given in the default table. (Equations 2, 3, 6, 7, 8.)

GROWTH OF HEADINGS

The next two parameters are optional. It appears that many libraries are not able to supply values for items 10a and 10b at this time. If values are not supplied, then they will be estimated using a curve for the number of unique headings per title, UHPT(I,N) described in Chapter 7.

10a. HT(I,Y) is the total number of unique headings associated with titles of class I that are in the library on June 30 of year Y when Y=1, 2, 3, 4 and 5. For convenience of computation, HT(I,O) is the total number of such headings on January 1, 1981. Libraries that maintain an authority file, and have kept records on the size of that file over a number of years will be in a position to estimate values for HT(I,Y) using the procedure described under item 7. A library that maintains an authority file in card form may estimate the number of headings in the library at any given time by first measuring the number of inches of cards in the file and then multiplying this number by the number of cards per inch (approximately 100 cards per inch). (Equations 23 - 26.)

10b. NHN(I,Y) is the number of unique headings associated with those titles of class I that are newly cataloged in year Y and after January 1, 1981. For Y=1, this parameter is associated with only 6 months of newly cataloged titles; for Y=2, 3, 4, and 5 this parameter is associated with 12 months of newly cataloged titles. Because there is a greater degree of overlap among headings in a large set of titles than there is in a small set, the number of unique headings associated with titles newly cataloged in one year would be expected to be less than 52 times the number of unique headings associated with titles newly cataloged in one week. Therefore

scaling up results based on a one week sample to obtain the annual figure may be misleading. One possible way of estimating the parameter NHN(I,Y) is to first perform a computer analysis of OCLC (or comparable) tapes for the set of titles cataloged during a one year period; the result of this analysis would be the unique number of headings associated with these titles. Then one can multiply the number of unique headings obtained from the computer analysis of OCLC tapes by the ratio of TN(I,Y) to the number of titles entering the computer analysis to arrive at NHN(I,Y), for Y=1, 2, 3, 4 and 5. (Recall that TN(I,Y) is assumed to be known from item 7.) This procedure is based on the assumption that over a limited range of values for the number of titles cataloged in one year, the number of unique headings associated with these titles is approximately proportional to the number of these titles. (Equations 23, 28, 30.)

CATALOGING AND EDITING COSTS

11. The average cost of cataloging a title of class I, CCPT(I) encompasses the intellectual work of cataloging including pre-catalog searching, authority checking, etc. The average figure includes all types of cataloging; e.g., original cataloging, cataloging when LC copy is available, and cataloging when shared copy is available. This cost includes the cost of using the cataloging data base maintained by a bibliographic utility, but does not include the cost of maintaining a separate newly created data base to generate a public COM or on-line catalog. Figure C.2 is worksheet that may be used for estimating the annual cost for this task. The number of titles produced per year by this task is item 6, TN(I,Y). (Equation 31.)

12. CEOPT(I) is the average annual cost of editing per title of class I in the old file. This is the cost of intellectual work, not the physical maintenance. (The physical maintenance is covered by item 34 if the old file is in card form and item 52 if the old file is in machine-readable form suitable for producing a COM catalog.) Some libraries keep records from which this parameter can be readily estimated. For example, if the annual cost of editing titles of class I, the existing catalog is available for a given year, the parameter CEOPT(I) should equal this cost divided by the average number of titles in the file during that year. If this annual cost is not available, it can be estimated using the worksheet of Figure C.1. (Equation 33.)

Another way of estimating CEOPT(I) is to obtain values for two quantities: (1) the average cost of editing per title of class I operated on and (2) the percent of the titles operated on, and then multiply these values together. Quantity (2) may be approximated by item 35, for which a default value is available. Quantity (1) may be estimated using the worksheet of Figure C.2 with a supplementary column to tally the number of titles operated on.

13. CECPT(I) is the average annual cost of editing per title of class I in the new or unified card file, exclusive of the cost of resolving conflicts resulting from AACR 2. It may be estimated using the methods described for item 12. (Equations 36, 37, 40.)

Figure C.2

WORKSHEET FOR ESTIMATING STAFF COSTS

Work Task: _____

_____

For the work task identified above, list below those staff members who are involved to any extent in the task. Record the hourly salary/wage rate for each staff, including taxes and fringe benefits. Have a supervisor estimate the hours per week spent in a typical week for this task for each staff listed. After the supervisor estimates the time on this task for each person, you should get the individuals to also estimate for themselves the time spent in a typical week on this task. You should arrive at a reasonable average estimate by comparing the two estimates. Multiply by 52 to obtain the annual estimate.

Staff Name	Salary/Wage hourly rate	Hours/week on task	Estimated weekly cost

14. CEMRPT is the average annual cost of editing per title of class I in the new or unified machine-readable file. This is the cost of intellectual work, not the physical maintenance. (The physical maintenance is covered by item 52.) A library that has costed the editing of its OCLC or other archival tapes may be able to help us develop this figure for a machine-readable file. (Equations 38, 39, 41.)

COST OF RETROSPECTIVE CONVERSION

15. The number of types of records used as the basis for the conversion, NRT, may be 1, 2, or possibly more. For example, if a conversion is based on OCLC tapes and shelf-list cards, then NRT = 2 with

J = 1 meaning shelf-list cards

J = 2 meaning OCLC tapes.

At present, NRT must not exceed 5.

Please fill in the value for NRT appropriate for your library and assign meaning to values of J between 1 and NRT in the spaces provided.

16. The cost of creating a machine-readable record suitable for producing a COM or on-line catalog for titles of class I from records of type J, CCPR(I,J), has been estimated in Appendix A for the several cases of interest to libraries However, your library may have even better estimates based on work study results. Figure C.2 may be used for this purpose. (Equations 75, 76.)

17. The planned number of suitable machine-readable records created during fiscal year Y for titles of class I from records of type J, RC(I,J,Y), is a quantity used for two purposes: to estimate the costs of retrospective conversion, and to increase the size of the new machine-readable file. For the later purpose it is assumed that the number of records created equals the number of titles added to the new machine-readable file. To obtain an estimate of RC(I,J,Y) your library must decide on its plans for retrospective conversion through 1985. Perhaps a fixed percent of the library budget will be devoted to RECON and this will produce a certain number of machine-readable records per year. (Equations 18, 19, 75, 76.)

18. This input, RCO(I,J) is the number of machine-readable records of class I titles created from records of type J between June 30, 1980 and January 1, 1981. This input affects only the retrospective conversion costs and not the growth of the new machine-readable file over the 5-year planning period. Typically, RCO(I,J) would be associated with the cost of producing a COM catalog of the old file or producing a unified on-line or COM catalog by 1 January 1981. (Equation 75.)

COSTS OF AUTHORITY CONTROL AND LINKAGES AND HEADINGS CHANGES RESULTING FROM AACR-2

19. CACPT(I) is the average annual cost of maintaining an authority file per title of class I. Authority work done during cataloging should not be included in this cost. This includes the cost of both intellectual and physical labor. If your library does not have an authority file then this input is zero. Figure C.2 may be used to make an estimate of this parameter at your library. (Equation 34.)

20. This input, CRCPC(I), is the average cost of intellectual work required to resolve a substantial heading conflict resulting from AACR 2 for a title of class I. Some libraries keep records from which this parameter may be estimated (assuming that conflicts from AACR 2 are similar to other conflicts). The worksheet of Figure C.2, supplemented with a column to tally the number of substantial conflicts resolved, may also be used. (Equation 42.)

21 to 25. This set of inputs is capable of describing a wide range of possible approaches for dealing with AACR 2. (See Equations 44 and 46.) Some of these approaches are:

a. Treat all conflicts by changing the form of headings in the existing catalog. For this approach, the percent of substantial heading conflicts treated by heading changes, PCTHC(I), would be set equal to 100, and the complementary percentage, PCTL(I), would equal zero.

b. Treat all conflicts by providing linkages between the old and the new files. For this approach, the percent of substantial heading conflicts treated by linkages, PCTL(I), would equal 100 while the complementary percentage, PCTHC(I), would equal zero. Whether the linkages were one-way (old file to new file, or new file to old file) or two-way would be reflected in the value of the parameter, CLPH(I), the average cost of producing linkages, interfiling, etc. per heading change treated.

c. Treat all conflicts by interfiling all cards with the AACR 1 heading immediately after the cards with the AACR 2 form of the same heading and provide a cross-reference under the AACR 1 heading. Again, PCTL(I) would equal 100 and PCTHC(I) would equal 0. However, the interpretation of the parameter CLPH(I) in this case would be different, viz. CLPH(I) would equal the average cost of interfiling and setting up cross-references per heading conflict.

d. When a heading conflict is resolved, first determine how many records are affected. If three or fewer records are involved, then change the headings to the new form. If four or more records are involved, then provide linkage. (Critical values other than three, of course, could be used in making this decision.) To estimate the

parameters for this approach requires that we have the distribution of the number of records per heading conflict; this could be approximated by the distribution of the number of records per heading. For this approach, the value of PCTHC(I) equals the percent of headings with 1, 2 or 3 records per heading, and the value of PCTL(I) equals the percent of headings with 4 or more records per heading. See item 25 concerning the determination of PCTL(I) in this case.

23. CHCPR(I) is the average cost of making a heading change on an existing bibliographic record of a class I title. This cost depends strongly on the method used to make heading changes. For example, if they are made by means of a computer the cost will be much smaller than if they are made manually. See the discussion under item 27. For manual changes this parameter may be estimated using a value from the default table. However, it is preferable to estimate the value for your library. This can be accomplished by means of Figure C.2 supplemented with a column for tallying the number of heading changes made. (Equation 44.)

24. CLPH(I) is the average cost of producing linkages, interfilings, etc. per heading conflict treated. This parameter depends strongly on how the linkage (or interfiling, etc.) is performed. The worksheet of Figure C.2, again, may be used to estimate this parameter. (Equation 46.)

25. The average number of records requiring changes per heading change for titles of class I, RPH(I), depends on what approach is adopted. Of the four approaches discussed under 21-25, a. and d. both involve making heading changes. For approach a., where all conflicts are treated by making heading changes, RPH(I) is the average value of the entire distribution of records per heading. For approach d., where only those headings involving 1, 2 or 3 records are changed, RPH(I) is at most three and can be estimated by forming the weighted sum of 1, 2, and 3 with weights equal to the probabilities of occurrence of 1, 2 and 3 records. A similar method for estimating RPH(I) can be used if a critical value other than 3 is used as the basis for deciding whether to apply links or heading changes. (Equation 44.)

26. The percentage of headings of class I titles in the existing catalog that are in conflict with AACR 2 on January 1, 1981 FHCS(I) has been estimated in a number of studies. If in-house data is not available for this quantity, it is recommended that the values in the default table be used. (Equations 48 - 53.)

27. NHC(I,Y) is the number of substantial heading conflicts resolved and treated in year Y for titles of class I. Normally this is estimated within the model under the assumption that we resolve and treat only those conflicts created by newly cataloged titles in year Y. This is accomplished by a set of equations in the model; they are based on these quantities: (1) the total number of unique headings in the existing file from year to year, (2) the percent of these headings in conflict with AACR 2 on January 1, 1981, and (3) the number of unique headings associated with titles newly cataloged each year. Quantities (1) and (3) are obtained from the number of unique headings per title, UHPT(I,N), and the appropriate number of titles. (Equations 49, 50, 52 and Equations 42, 44, 46.)

If your library adopts a different policy for resolving and treating heading conflicts, you have the option of overriding the estimates for NHC(I,Y) determined within the model using your own values. A situation where you might want to exercise this option is this: your bibliographic records are in machine-readable form, and a computer program is available which automatically converts AACR 1 headings to AACR 2 headings. In this case, you could apply the computer program to your records, and thereby resolve and treat all your conflicts in year 1. The number of conflicts resolved and treated in year 1 in this case equals the number of headings in the existing catalog on January 1, 1981 multiplied by item 27 divided by 100. For the years Y=2, 3, 4, 5, NHC(I,Y) would be zero. (Equations 42, 44, 46 only.)

COST OF CARD CATALOGS

28. K(I), the average number of catalog cards required per title of class I for the old catalog, is available at most libraries, but values are also available in the default table. For the main computer run this includes only the main catalog plus the shelf-list not the branches. For the supplementary computer runs this includes cards for the branches, but not the main catalog. (Equation 60.)

29. KN(I) is the average number of catalog cards required per title of class I for the new or unified card catalog. For a split catalog KN(I) would normally equal K(I). However, if the new card catalog is used as a backup for the COM or on-line catalog, then KN(I) might be different from K(I). For example, if only a shelf-list catalog is used as backup for the new COM or on-line catalog, then KN(I) would equal 1. (Equations 56, 57 58, 60.)

30. CCL(I) is the average cost of producing a catalog card locally for class I titles. Estimates for this quantity are available at many libraries, and one is also presented in the default table. (Equation 64.)

31. FL is the percent of catalog cards that are produced locally. The remainder of these cards are assumed to be produced by a network. (Equation 64.)

32. CN is the average cost of producing a card by means of a network. The value for this parameter is available from your network, and the default table has an estimate as well. (Equation 64.)

33. CFSPC is the cost of sorting and filing per card. This includes the cost of both manually produced and network produced cards and the cost of filing revision. For libraries that keep records on this cost for all the cards, this may be estimated by dividing the total cost by the number of cards for newly cataloged titles. For libraries that do not have records on this cost, an estimate is available in the default table. (Equation 65.)

34. CMPC(I) is the average cost of pulling, changing, refiling, revision, etc., per card treated for class I titles. Depending on what procedures are used in your library the value of this parameter may equal that of CHCPR, item 23. For libraries that have records on the total card maintenance cost, this parameter can be estimated using a value of FM(I), item 35, and the total number of cards in the library at the end of the year. Other libraries may use an estimate from the default table. (Equations 66 - 68.)

35. FM(I) is the percent of cards for class I titles in the card catalog at the end of the fiscal year requiring pulling, changing, refiling, etc. excluding the effect of AACR 2. This can be estimated at some libraries but may also be obtained from the default table. (Equations 66 - 68.)

36. CPCB is the average number of cards per cabinet. Estimates for this parameter are available at most libraries as well as from the default table. The default figure assumes utilizing an optimum 60% of the drawer space. (Equations 69 - 73.)

37. SQPC is the number of square feet of floor space per cabinet including space for a reference table and users. This can be readily measured, or obtained from the default table. (Equations 69 - 71.)

38. CCAB is the average cost of acquiring a card cabinet. Your business office probably has the answer; so does the default table. (Equation 72.)

39. CSQ is the cost per square foot of floor space; this amounts to a rental cost where applicable. Check with your business office. Where space is no problem, then a zero value might be appropriate. (Equations 69 - 71.)

40-41. Some libraries expand their catalogs every 5 years or so while others expand annually or even more frequently. CEPC is the cost of catalog expansion divided by the total number of cabinets at the time of expansion. PBCE is the period between expansions, expressed in years. If your library expands its card catalog once a year or more frequently, use your annual cost for expansions for estimating CEPC and assume PBCE is equal to 1 year. (Equations 73, 74.)

COM (OR FILMED) CATALOG COSTS

42. NCOMRI(Y) is the number of microform readers acquired and installed in your library in year Y. The number of readers in the library before the 1981 fiscal year should be entered for Y=0; the acquisition and installation costs for these do not appear in the cost results, however. (Equation 103.)

An estimate of the number of microfiche readers required to support your patrons can be estimated using the University of Toronto's experience, where the COM usage is well developed. One COM catalog supports approximately 300 daily users. See Appendix A.

43. NCO(Y) is the number of copies of the COM (or filmed) catalog of the old file produced per update (and per cumulative supplement) in year Y. In general, NCO(Y) will vary with Y because the number of available readers will vary with Y. This number should be a by-product of your estimate of NCOMRI(Y) unless you plan to make copies available to other libraries. (Equation 93.)

44. NC(Y) is the number of copies of the COM catalog for the new or unified file per update (and per cumulative supplement) in year Y. In general, it will vary with Y because the number of available microform readers will vary. (Equation 94.)

45. NUO(Y) is the number of updates of the entire COM (or filmed) catalog of the old file in year Y. For a COM catalog one would normally adopt a policy where the number of updates per year is constant. Monthly updates would mean NOU(Y) = 12 for all values of Y; and annual updates would mean NOU(Y) = 1 for all values of Y. For the alternative involving freezing the old card file, photographing it, and making a microform catalog from it, there would presumably be no additional updates. If the cost of producing the microform catalog of the old file is to appear in year Y=1, and no additional updates are made, then we would have NOU(1) = 1 and NOU(Y) = 0 for Y = 2, 3, 4, 5. The production costs for such a catalog, of course, are different from that of a COM catalog but can be described in terms of the parameters of item 53. (Equations 95, 101.)

46. NSO(Y) is the number of cumulative supplements. If weekly supplements are desired, then NSO(Y) = 52; if monthly supplements are desired, then NSO(Y) = 12, etc. If updates only are used then NSO(Y) = 0. (Equations 95, 101.)

47. NU is the number of updates of the entire COM catalog of the new or unified file per year. The rationale for arriving at an estimate of NU appears under item 45. (Equations 96, 97, 102.)

48. NS is the number of cumulative supplements of the new or unified file per year. Weekly supplements are characterized by NS = 52, monthly supplements by NS = 12, etc. If updates only are used, NS = 0. (Equations 96, 97, 102.)

49. TSPO is the number of titles appearing in the cumulative supplement of the old file. (Equation 95.)

50. CERPT(I) is the average cost per newly cataloged title of class I of creating machine-readable records suitable for producing a COM catalog, exclusive of the cost of producing catalog records. This includes the cost of converting a catalog record into a form suitable for producing a COM catalog. Estimates for this parameter are given in the default table. (Equation 78.)

51. CSRPT(I) is the average annual cost per title of class I of storing machine-readable records suitable for creating the COM catalog. See the default table for estimates of this parameter. (Equations 79, 80, 81.)

52. CMRPT(I) is the average cost per title of class I of maintaining machine-readable records. This includes the costs of keying in corrections, making deletions, etc., excluding the impact of AACR 2. This does not include the intellectual work of editing. For libraries with operating COM catalogs, this parameter may be estimated by means of the worksheet in Figure C.2. For others consult the default table for estimates. (Equations 82 - 84.)

53-54. COM (or filmed) catalog production factors describe the physical characteristics of the catalog and its costs. These factors are:

(1) The number of full records (or displays) in the catalog per title, NFRPT and NFRPTO.

(2) The number of short records (or displays) in the catalog per title, NSRPT and NSRPTO.

(3) The average number of lines of output per full record in the catalog, LPFR and LPFRO.

(4) The average number of lines of output per short record in the catalog, LPSR and LPSRO.

(5) The average cost of processing a record (or display) in the catalog, CPR and CPRO.

(6) The average number of lines of output per fiche (or foot of film).

(7) The cost of producing a master fiche (or foot of master film), CPMF and CPMFO.

(8) The cost of producing a copy fiche (or foot of copy film), CPCF and CPCFO.

(9) An additive cost which does not depend on the number of titles, incurred each time a new version of the catalog is produced, COR and CORO.

Default figures are available for several options of interest. (Equations 85 - 100.)

55. CMCOM is the average annual cost of maintaining a microform reader. Although a default figure is available, the particular reader you intend to acquire and install may differ somewhat from that figure. (Equation 106.)

56. CDCOM is the cost of delivering a COM catalog and preparing it for display. This cost may well be negligible; but a recent study was criticized for having omitted it. To estimate its value you must trace through the functions and costs involved in delivering and preparing for display the COM catalogs, and estimate the corresponding costs. (Equations 101, 102.)

57. CICOM is the cost of acquiring and installing a microform reader. An estimate for this parameter, including its components, is given in the default table. (Equation 104.)

58. CSPCOM is the cost of space for one microform reader. This can be determined from the square feet of space required for a microform reader and CSQ, item 39. Also, see the default table. (Equation 105.)

COST OF ON-LINE CATALOGS

59. The various contributions to the cost of having an on-line catalog, except for the cost of retrospective conversion, which was discussed under items 16-19, are described in Appendix A. These costs include space, the cost of the central processing unit and related processing hardware, disk storage, development, terminals, installation, hardware and software maintenance, and data base management. For main-frame systems there may also be additional equipment operator costs. (Equations 107, 108.)

As a first step in arriving at the costs for central processing hardware and disk drive costs, one must estimate the number of terminals required for the on-line system. As a rough first approximation, one may assume that one terminal will be required for every 120 daily uses; this is consistent with predictions at the University of Guelph. See Appendix A.

COST OF TRAINING AND ORIENTATION

60. CTTS(Y) is the cost of training the technical services staff of your library concerning changes in the form of the catalog in year Y; CTPS(Y) is the cost of training the public services staff of your library concerning these changes in year Y. These include the cost of both labor and materials. The default table contains rough estimates for these costs. A more refined estimate can be obtained by developing a training and orientation plan and costing it out for each of the purposes. See Appendix A for ideas about training.

COST OF CATALOG USAGE BY NON-CATALOGING STAFF

61. NSERO(Y) and NSER(Y) are the number of searches in year Y by non-cataloging staff using the old file, and using the new or unified file, respectively. (Equation 109.)

One way of estimating these parameters is as follows. Have all non-cataloging staff keep a record of the number of searches made in a one-week period. The non-cataloging staff should be grouped by type of staff such as reference, acquisitions, interlibrary loan, etc. Each person would maintain the following counts:

- o number of searches
- o number of entries checked in search
- o time to check entry (lookup)

Records would be kept for one week (7 days assuming library open 7 days). The one week results would be multiplied by 52 for annual estimates for each individual. The annual totals would be estimated by aggregating over all non-cataloging staff involved.

In order to arrive at estimates for new file, it will be important to have the above data as a function of age of the title being searched. The following data collection form is recommended:

Name_____ Datc_____
Dept._____

Search Number	Number of Entries	Time (minutes)	Age of Title Searcned (in months)
1			
2			
3			
4			
5			
.			
.			
.			

The last column of the above data form can be used to estimate the percentage of searches that are made for titles whose ages are less than 6, 18, 30, 42, 54, etc., months. To arrive at these percentages, the following type of table (which contains hypothetical values for 400 searches) may be used:

Age (Months)	Number of Searches for Titles in Age Band	Percent of Searches for Titles in Age Band	Months (m)	Percent of Searches for Titles With Age Less Than (m)
0-6	10	25	6	25
6+-18	160	40	18	65
18+-30	80	20	30	85
30+-42	40	10	42	95
42+-54	10	2.5	54	97.5
54+	10	2.5		
	400	100		

This distribution of ages can be used to estimate the number of searches in year Y using the old file and using the new file. For example, consider the case where a new file was started on January 1, 1981 with no backlog of titles in it. On June 30, 1981, i.e., at Y = 1, the new file will be six months old. Consequently the percentage of searches that are made on the new file should equal the percentage of searches made for titles whose ages are less than 6 months. The complementary percentage (i.e., 100 minus the 6 month percentage) of searches should be made for titles whose ages exceed 6 months; these searches are made on the old file in year Y = 1. On June 30, 1982, i.e., at Y = 2, the new file will be 18 months old. Consequently the percentage of searches that are made on the new file should equal the percent of searches that are made for titles whose ages are less than 18 months. The complementary percentage should be made for searches whose ages exceed 18 months; these searches are on the old file in year Y = 2. This reasoning can be extended to year Y=5, and used to estimate values of NSERO(Y) and NSER(Y) for the old and the new file. When a unified file is used, then all the searches are made on it and the above analysis is not necessary.

If on Janary 1, 1981 the new file starts with a backlog of all titles whose ages are 2 years old or less, a similar line of reasoning applies so that at Y=1, the percentage of searches made on the new file equals the percentage of searches that are made for titles whose ages are less than 30 months, etc.

62. NECPSO and NECPS are the number of entries checked to complete a search in the old file and in the new or unified file, respectively. Estimates for these parameters may be estimated as discussed above. (Equation 109.)

63. TCEO and TCE are the average times (in seconds) to check an entry in the old and in the new or unified file, respectively. Estimates for these quantities for new alternatives may be obtained from the default table which is perhaps the only reasonable route when considering an alternative involving a COM or on-line system not yet installed in the library. Estimates for existing operations may be made as discussed above. (Equation 109.)

64. CSTPH is the average hourly cost per member of the library staff performing the searches. The worksheet of Figure C.2 may be used to estimate this parameter. (Equation 109.)

COST ADJUSTMENTS

65. CPRL(Y) is the cost (or savings) resulting from non-cataloging personnel reallocation in year Y; CSPR(Y) is the cost (or savings) resulting from space reassigned in year Y; CED(Y) is the cost (or savings) resulting from equipment disposition in year Y; and CMISC(Y) are costs (or savings) which should be entered into the cost computation but were omitted in the preceding considerations. All of these quantities are adjustments for costs (or savings) not explicitly accounted for in the cost model. Only your careful review of the alternatives and their cost implication for your library will reveal the presence of such costs or savings. If the presence of such a cost is established, and you feel that it will affect some alternatives differently from others by a significant amount, it is probably worth estimating. In this case you may be able to estimate it using procedures similar to those already described. Remember that costs should be entered with a positive sign, and savings should be entered with a negative sign.

APPENDIX D

Name _____

Phone _____

INPUT FORM FOR THE LIBRARY CATALOG COST MODEL
(Main or Supplementary Run)

Run Identification

1. Library name, LIB: _____

2. Run identification, RID: _____

3. Date of submission, DOS: _____

4. Basic alternative, ALT: _____

Growth of Titles

5. Number of classes of titles, NCT: _____

   I = 1: _____
   I = 2: _____
   I = 3: _____

6. Number of titles of class I newly catalogued during year Y, TN(I,Y):

I \ Y	1	2	3	4	5
1					
2					
3					

I		
1	2	3

7. Total titles on 6/30/80, TTO(I):

8. Titles in new card file 1/1/81, TNCFS(I):

9. Titles in new MR file 1/1/81, TNMRFS(I):

10. Titles withdrawn in year Y, TW(I,Y):

I \ Y	1	2	3	4	5
1					
2					
3					

Growth of Headings

Optional:

10a. Total number of unique headings associated with titles of class I that are in the library in year Y, HT(I,Y):

I \ Y	0	1	2	3	4	5
1						
2						
3						

10b. Number of unique headings associated with titles of class I newly cataloged in year Y, NHN(I,Y):

I \ Y	1	2	3	4	5
1					
2					
3					

Cataloging and Editing Costs

11. Average cost of cataloging a title, of class I:

12. Annual cost of editing old file per title:

13. Annual cost of editing the new or unified card file per title:

14. Annual cost of editing the new or unified MR file per title:

I	1	2	3
CCPT(I)			
CEOPT(I)			
CECPT(I)			
CEMRPT(I)			

Cost of Retrospective Conversion

15. Number of types of records used for RECON, NRT: _____

J = 1: _____

J = 2: _____

J = 3: _____

J = 4: _____

16. Cost of creating a record for a title of class I from records of type J, CCPR(I,J):

I \ J	1	2
1		
2		
3		

17. The planned number of records created in year Y for titles of class I from records of type J, RC(I,J,Y):

J = 1

I \ Y	1	2	3	4	5
1					
2					
3					

J = 2

1					
2					
3					

18. The number of previously created records for title of class I from records of type J, RCO(I,J):

I \ J	1	2
1		
2		

Cost of Authority Control and Linkages, Heading Changes Resulting from AACR-2

	I		
	1	2	3
19. Annual cost of maintaining authority file per title of class I, CACPT(I):			
20. The average cost of resolving a conflict for a title of class I, CRCPC(I):			
21. Percent of conflicts in titles of class I, treated by heading changes, PCTHC(I):			
22. Percent of conflicts in titles of class I, treated by linkages, etc., PCTL(I):			
23. Average cost of making a heading change per record for class I title, CHCPR(I):			
24. Average cost of linkage, etc. per heading for a title of class I, CLPH(I):			
25. Records changed per heading change for title of class I, RPH(I):			
26. Percentage of headings of class I titles in conflict, FHCS(I):			

	Y				
	1	2	3	4	5
27. Optional: Number of conflicts treated in year Y for class I titles, NHC(I,Y):					

Cost of Card Catalogs

	I		
	1	2	3
28. Average number of catalog cards required per title of class I for the old or unified catalog, K(I):			
29. Average number of catalog cards required per title of class I for the new catalog, KN(I):			
30. Average cost of producing a catalog card locally for class I titles, CCL(I):			

31. Percent of catalog cards produced locally, FL: _____

32. Average cost of producing a card by network, CN: _____

33. Cost of sorting and filing per card, CFSPC: _____

34. Average cost of pulling, changing, refiling and revision per card treated for class I titles, CMPC(I):			

35. Percent of cards for class I titles requiring pulling, changing, refiling, etc., excluding the impact of AACR-2, FM(I):

I		
1	2	3
____	____	____

36. Average number of cards per cabinet, CPCB: _____

37. Square feet of floor space per cabinet, SQPC: _____

38. Cost of acquiring and installing a card cabinet, CCAB: _____

39. Cost per square foot of floor space, CSQ: _____

40. Labor cost of catalog expansion per cabinet, CEPC: _____

41. Period (in years) between catalog expansions, PBCE: _____

COM or Microform Catalog Costs

42. Number of microform readers acquired and installed in year Y, NCOMRI(Y):

43. Number of copies of catalog of old file produced per update (or supplement) in Year Y, NCO(Y):

44. Number of copies of catalog of new or unified file produced per update in year Y, NC(Y):

45. Number of updates of entire COM (or microform) catalog of old file in year Y, NUO(Y):

46. Number of cumulative supplements of old catalog in year Y, NSO(Y):

Y					
0	1	2	3	4	5
___	___	___	___	___	___
	___	___	___	___	___
	___	___	___	___	___
	___	___	___	___	___
	___	___	___	___	___

47. Number of updates of entire COM catalog of new or unified file per year, NU: _____

48. Number of cumulative supplements of the new or unified file per year, NS: _____

49. Number of titles of class I appearing in the cumulative supplement of the old file, TSPO(I):

50. Cost of entering new records per title, CERPT(I):

51. Cost of storage for old records per title, CSRPT(I):

52. Cost of maintaining old records per title, CMRPT(I):

I		
1	2	3

53. COM (or microform catalog) production factors for old file:

	I		
	1	2	3
NFRPTO(I):			
NSRPTO(I):			
LPFRO(I):			
LPSRO(I):			
CPRO(I):			

LPFO: _____

CPMFO: _____

CPCFO: _____

CORO: _____

54. COM production factors for new or unified file:

	I		
	1	2	3
NFRPT(I):			
NSRPT(I):			
LPFR(I):			
LPSR(I)			
CPR(I):			

LPF: _____

CPMF: _____

CPCF: _____

COR: _____

55. Average annual cost of maintaining a COM reader, CMCOM: _____

56. Average cost of delivering a COM catalog, CDCOM: _____

57. Cost of acquiring and installing a COM reader, CICOM: _____

58. Cost of space for one COM reader, CSPCOM: _____

Cost of Online Catalogs

59.

Cost of	Year Y 1	2	3	4	5
Space, CSP(Y):					
Computer processing hardware, CHWA(Y):					
Disk Drives, CDA(Y):					
Terminals, CTERM(Y):					
Development Costs, CDEV(Y):					
Installation Costs, CINO(Y):					
Equipment Operators, CEO(Y):					
Hardware Maintenance, CHWM(Y):					
Software Maintenance, CSWM(Y):					
Data Base Maintenance, CDBM(Y):					
Computer Rental, CCRENT(Y):					

Cost of Training and Orientation

60.

Cost of	Y 1	2	3	4	5
Training T.S. Staff, CTTS(Y):					
Training P.S. Staff, CTPS(Y):					
Orienting Users, COU(Y):					

Cost of Catalog Usage by Non Cataloging Staff

61.

	Y 1	2	3	4	5
Staff uses of old catalog, NSERO(Y):					
Staff uses of new or unified catalog, NSER(Y):					

62. Entries checked per search of old catalog, NECPSO: _____

Entries checked per search, new or unified catalog, NECPS: _____

63. Time to check entry, old catalog, TCEO: _____

Time to check entry, new or unified catalog, TCE: _____

64. Cost of staff per hour, CSTPH: _____

Cost Adjustments

65.

Costs (savings) from:	Year Y 1	2	3	4	5
Personnel Reallocation, CPRL(Y):					
Space Reassignment, CSPR(Y):					
Equipment Disposition, CED(Y):					
Miscellaneous, CMISC(Y):					

NAME _____

PHONE _____

INPUT FORM FOR A COMBINING RUN

RUN IDENTIFICATION

1. Library Name, LIB _____
2. Run Identification, RID _____
3. Date of Submission, DOS _____

Item 2 is the run identification of the combined result.

RUNS TO BE COMBINED

Please identify the runs to be combined by writing the first four characters of the run identification of each in the list below:

_____

_____

_____

_____ _____

APPENDIX E

DEFAULT FIGURES
(as of August 15, 1979)

There may be a number of input elements which a library may not be able to develop in the time available. Many of these have been obtained by a review of the literature and queries of several libraries known to have done some research on alternatives to the card catalog.

These figures are summarized herein with references to the pages in the background paper, Appendix A, where more details may be found. Also provided is a confidence rating: A for those figures which are highly reliable; B for those which are reliable, but for which some variance may be expected; and C for those for which only a single source was available and there is a good prospect for major variance.

Default figures are arranged by the numbers in the input form (Appendix D). No figures are provided when the data can be provided by the library.

10. Titles withdrawn - TW
    0.25% (B, estimated from ARL statistics)

11. Average cost of cataloging a title - CCPT
    $17.00 (C, p. A-11)

12. Intellectual cost of editing old file - CEOPT
    $0.02 (C, developed from participants' data)

13. Cost of editing new card file - CECPT
    $0.02 (C, developed from participants' data)

14. Intellectual cost of editing new machine-readable file - CEMRPT
    $0.015 (C, developed from participants' data)

16. Cost of creating a record - CCPR

For producing a record by retrospective conversion using a bibliographic utility	$0.67 per title (B, A-16)
Reformatting communications format to operating format when an archival tape is available from a bibliographic utility	$.05 per title (B, p. A-18)
Full keying for brief records	$0.585 per title (B, p. A-18-19)
Full keying for full records	$1.365 per title (B, p. A-18-19)
Brief keying for matching	$0.46 per title (B, p. A-18-19)

(Full keying will be necessary for the 20-40% not matched.)

19. Cost of maintaining an authority file - CACPT
    $0.02 (C, developed from participants' data)

20. Average cost of resolving conflict - CRCPC
    $2.50 (B, developed from participants' data)

23. Average cost of a heading change - CHCPR
    On cards $0.325 (B, p. A-13)
    On machine-readable record $0.10 (C, ISCI estimate)

24. Average cost of linkages - CLPH
    In card catalogs: one way $0.10, two way $0.20 (B, p. A-15)

25. Records changed per heading change - RPH
    Each card is considered a record.
    For personal name headings 58 (C, p. A-13-14)
    For corporate headings 300 (C, p. A-13-14)
    For all headings 120 (C, developed from participants' data)

26. Percentage of headings in conflict - FHCS
    13% (A, p. A-7)

28. Average number of catalog cards per title - K
    medium library 7 (B, p. A-11)
    large library 9 (B, p. A-11)

29. Average number of cards per title for new catalog - KN
    medium library 7
    large library 9, unless a more limited back-up catalog

30. Cost of a catalog card locally - CCL
    $0.145 (B, p. A-11)

32. Cost of network card - CN
    $0.04 (A, p. A-11)

33. Cost of sorting and filing - CFSPC
    $0.125 (B, p. A-12)

34. Cost of pulling, changing, refiling, revising - CMPC
    $0.225 (B, p. A-13)

35. Percent of cards to be pulled - FM
    1.0% (C, p. A-13-14)
    1.3% (B, participants' data)

36. Cards per cabinet - CPCB
    43,000 (B, p. A-11)
    62,000 (B, participants' data)

37. Square feet per cabinet - SQPC
    30 sq. ft. (A, p. A-12)

38. Cost of acquiring and installing a cabinet - CCAB
$1800 plus $125 for reference tables or $1925 (A, p. A-11)

39. Cost per square foot - CSQ
$5 (B, p. A-12)

40. Labor cost per cabinet expansion - CEPC
$90 (B, p. A-12)

41. Period between catalog expansion - PBCE
3 years (C, developed from participants' data)

42. Number of microform readers - NCOMRI
One per 300 daily users (B, p. A-20)

50. Cost of entering new records - CERPT
The creation of a new record normally involves two steps, the first producing a MARC communications format record through a bibliographic utility at an average cost of $1.00 per title (see default 16.) The second step is reformatting the records into an operating format at a cost of $0.05 per title.

51. Cost of storing data - CSRPT
$0.01 per record annually (B, estimated)

52. Cost of maintaining records - CMRPT
$0.03 per year (C, developed from participants' data)

53.-54. COM Production Factors

	In-house	Service Agency
LPFR(I)	7	7
LPSR(I)	3	3
CPR(I)	$0.0015	$0.006
LPF(I)	16,000	16,000 (1400)*
CPMF(I)	$1.05	$4.90 (0.68)*
CPCF(I)	0.075	$0.25 (0.13)*
COR(I)	0	0

*Numbers in parentheses are based on a foot of film instead of a fiche.

In-house production figures are consistent with University of California, Berkeley, Future of the General Library Catalogs, Phase IV Reports. Service Agency production figures are consistent with UTLAS charges.

If the old file is retrofilmed and used to produce a fiche catalog, then reasonable estimates are CPRO = 0 and CPMFO = $114.00.

55. Cost of maintaining microform reader - CMCOM
Microfiche $25 per year (B, p. A-21)
Microfilm $100 per year (B, p. A-21)

57. Cost of acquiring and installing a reader - CICOM

Microfiche reader purchase	$250
Fiche stands	65
File holders	50
Table	400
Electrical	50
Total for microfiche reader	$815 (B, p. A-21)
Microfilm reader purchase	800
Table	400
Electrical	50
Total for microfilm reader	$1250 (B, p. A-21)

58. Cost of space - CSPCOM
    $125 per reader

59. On-line catalog costs
    Simple listings of default figures are not possible in this section. See pages A-22-28 to determine default figures.

60. Cost of Training and Orientation

	Cards(C, p. A-15)	Micro(C, p. A-22)	On-line (C, p. A-27)
CCTS	1000	1000	6750
CTPS	500	500	3250
COU	1000	1000	1500

61. Staff use (C, developed from partipants' data)

	Y=1	Y=2	Y=3	Y=4	Y=5
Old catalog - NSERO(Y)	83,000	72,000	67,000	64,000	61,000
New catalog - NSER(Y)	17,000	28,000	33,000	36,000	39,000
Unified catalog-NSER(Y)	100,000	100,000	100,000	100,000	100,000

63. Time to check entries
    TCEO - 70 seconds (B, p. A-30)
    TCE - 80 seconds for micro (B, p. A-30)
    On-line - 20 seconds (B, p. A-30)